THE UNIVERSITY [illegible] 27 1931
LIBRARY

ENGINEERING FINANCE COMMERCE

THE FAR EASTERN REVIEW

上海黃浦灘念四號

遠東時報

HAS JAPAN THE RIGHT TO DEFEND HERSELF?

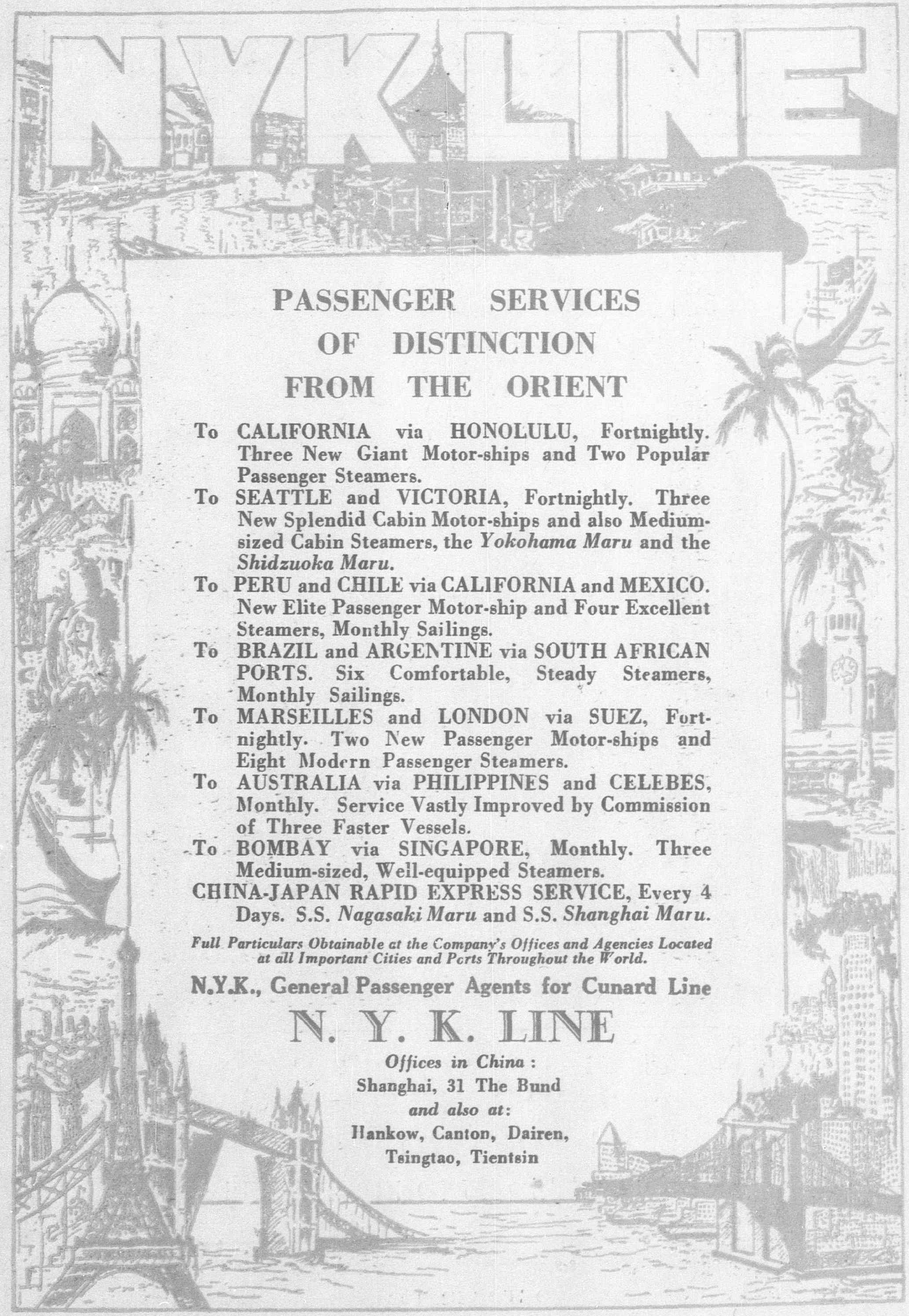
THE ROAD TO UNITY

"EXTRACTED UNDER DURESS"

Vol. XXVII

OCTOBER, 1931

No. 10



PASSENGER SERVICES
OF DISTINCTION
FROM THE ORIENT

To CALIFORNIA via HONOLULU, Fortnightly. Three New Giant Motor-ships and Two Popular Passenger Steamers.

To SEATTLE and VICTORIA, Fortnightly. Three New Splendid Cabin Motor-ships and also Medium-sized Cabin Steamers, the *Yokohama Maru* and the *Shidzuoka Maru.*

To PERU and CHILE via CALIFORNIA and MEXICO. New Elite Passenger Motor-ship and Four Excellent Steamers, Monthly Sailings.

To BRAZIL and ARGENTINE via SOUTH AFRICAN PORTS. Six Comfortable, Steady Steamers, Monthly Sailings.

To MARSEILLES and LONDON via SUEZ, Fortnightly. Two New Passenger Motor-ships and Eight Modern Passenger Steamers.

To AUSTRALIA via PHILIPPINES and CELEBES, Monthly. Service Vastly Improved by Commission of Three Faster Vessels.

To BOMBAY via SINGAPORE, Monthly. Three Medium-sized, Well-equipped Steamers.

CHINA-JAPAN RAPID EXPRESS SERVICE, Every 4 Days. S.S. *Nagasaki Maru* and S.S. *Shanghai Maru.*

Full Particulars Obtainable at the Company's Offices and Agencies Located at all Important Cities and Ports Throughout the World.

N.Y.K., General Passenger Agents for Cunard Line

N. Y. K. LINE

Offices in China :
Shanghai, 31 The Bund
and also at:
Hankow, Canton, Dairen,
Tsingtao, Tientsin

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XXVII SHANGHAI, OCTOBER, 1931 No. 10

Has Japan the Right to Defend Herself?

By *GEO. BRONSON REA*

ALL the great Powers, including Russia, have formulated and applied certain basic doctrines for safeguarding their national security. The recent action of Japan in Manchuria, followed by China's immediate appeal to the League for intervention, gives rise to the question as to whether Japan, alone of all powers, is entitled to the right to invoke the law of self-help when her vital interests are imperilled. "*We cannot apply one principle in one part of the world and another in another part,*" without inviting the defeat of every instrument yet devised for the preservation of world peace. What is just and good for Great Britain in India, in Egypt and in Mesopotamia; for France in Algeria and Morocco; for Italy in the Mediterranean and for the United States in the Caribbean, must also be just and good for Japan in Manchuria. *And with much greater reason.* For, whereas the menace in these other strategic regions is remote and problematical, it is imminent and real in Manchuria. The menace of Russia is drawing closer and closer to Japan and unless she moves and moves quickly to protect herself, neither the League, the World Court, the Kellogg Pact, the Four or the Nine Power Treaties can ward off the inevitable clash. For, make no mistake about this. Russia is at war with all the world. The war has begun through the Five Year Plan and the economic attack. When the time is propitious, the great Red Army will move and its first objective will be China. A special Far Eastern army has been created to take care of the Chinese situation. It's strength is shrouded in secrecy, but it is based on Irkutsk and Chita with a double track railway connecting these centers with European Russia and two huge steel mills, one at Kutnetz and the other at Magnetogorsk, capable of turning out over 3,000,000 tons of steel to supply it with munitions. Nothing is known of the strength of this army, but it is recognized by all competent military observers that its power of offense lies in the Soviet control of Mongolia. So aside altogether from the disputes between China and Japan over the validity of a treaty and other questions concerning Manchuria, there enters the right which every state enjoys to object to acts done by other powers which threaten its own security.

There is little to be gained by laboring the point. To state the facts is to state the case. Adhering to the basic and unalterable doctrine of Czarist Russia of preserving Mongolia as a buffer state between the Slav and Mongolian race, closed to Chinese penetration and colonization, the Soviet has successfully amputated this region from the main body of China and incorporated it into its system of independent socialist republics. In doing so, she has closed the territory to further Chinese penetration, and sealed it even against foreign travel and observation. No foreigner can visit, reside in, or traverse Mongolia without a Soviet passport—and these are not forthcoming, even for foreign consuls accredited to China.

Exactly as Russia operated in Manchuria from 1896 to 1904, she is now proceeding in Mongolia. Manchuria became a Russian province, closed to foreign trade and travel. Mongolia is now hermetically sealed, a closed Soviet preserve. Under cover of this profound secrecy and impenetrability, the Soviet has organized a Mongolian army and flanked Japan's strategic position in South Manchuria, once again using Chinese territory to prepare for the next aggressive move in the relentless advance of the Slav towards his ultimate goal.

China is powerless to defend her territory against this menace or discharge her international obligations. She has made no protest against the rape of Mongolia, either to Russia, to the League, to the signatory powers of the Kellogg Pact or the Nine Power Treaty. China has meekly accepted Russia's aggression, recognized the accomplished fact and resists every effort of Japan to defend herself against the "*menace from the direction of Urga.*" Japanese army officers, civilians or scientific parties travelling in the Mongolian border zones to gather information as to what is transpiring behind the screen, are either arrested or as in the case of Captain Nakamura, summarily executed as spies, not by the Soviet or Mongol authorities, but by Chinese generals in command of the border troops! For all practical purposes, the Chinese have allied themselves with Russia against Japan, permitting the former every opportunity to strengthen her strategic position while denying to the latter the right to defend herself. The situation is one that no self-respecting military organization would tolerate in any other part of the world. In effect, the situation is almost identical with that created by Japan's adherence to the Hay Doctrine in 1898 at a time when China had handed over Manchuria to Russia in order that the latter might get into a favorable strategic position to crush Japan. China's secret diplomacy in 1896 and her acquiescence in Russia's subsequent moves together with her inability to enforce respect for her sovereign rights or defend her neutrality, compelled Japan to stake her existence in 1904 on the plains of Manchuria. *History is repeating itself.*

Further away, the far-western province of Sinkiang is automatically gravitating into the Soviet system. It is only a question of time when the cat will swallow the canary. The Barga Mongols are asserting their right to independence. Yet the Chinese military overlords and bandit generals, intent upon their own senseless and useless wars, make no effort to preserve the integrity of their country, viewing with secret satisfaction and cynical indifference the penetration of Soviet influence that sooner or later will again compel Japan to fight for her existence on the plains of Manchuria.

The weakness, inefficiency, corruption and unconcern on the part of the Chinese militarists and their unwillingness or inability to discharge their duty towards Japan, brings into operation the law of self-defense! Mr. Charles Cheney Hyde, in his recent work on international law (a work which Mr. Hughes says is a lasting credit to the American bar,) sums up the principle in the following words:

> "It is subversive of justice among nations that any state should, in the exercise of its own freedom of action, directly endanger the peace and safety of any other which has done no wrong. Upon such an occurrence the state which is menaced is free to act. For the moment it is justified in disregarding the political independence of the aggressor and in so doing it may be guided by the requirements of its own defense. . . . It is not, therefore, the broad ground of self-preservation, but the narrower yet firmer basis of one form of self-preservation, that of self-defense, on which justification rests."

Mr. Elihu Root, in a complete exposition of this sound principle as applied to the Monroe doctrine, emphasizing the right of self-protection, as recognized by international law and as a necessary corollary of independent sovereignty, says:—

> "It is well understood that the exercise of the right of self-protection may, and frequently does, extend in its effect

> beyond the limits of the territorial jurisdiction of the state exercising it. The strongest example probably would be the mobilization of an army by another power immediately across the frontier. Every act done by the other power may be within its own territory. Yet the country threatened by this state of affairs is justified in protecting itself by immediate war."

The Monroe Doctrine as Mr. Hughes interprets it, "*rests upon the right of every sovereign state to protect itself by preventing a condition of affairs in which it will be too late to protect itself.*" As in the Monroe Doctrine, so in the case of Japan, the declaration of a purpose to oppose what is inimical to the national security does not imply an attempt to establish a protectorate or in any way encroach upon the sovereign rights of a neighboring state. In the same manner that the United States has interpreted the Monroe doctrine to safeguard its future peace and security, so Japan has the equal and undisputed right to invoke the same principles for the protection of its vital interests in Manchuria. If there were no Monroe doctrine, the United States would be compelled to create one, and in view of the events of history and Japan's acquired rights in Manchuria, she also would be compelled to create a similar doctrine for her own defense. Japan has rights and obligations which cannot always be defined and in the unsettled condition of Manchuria and the secrecy which prevails as to what is transpiring behind the screen in Mongolia and in Central Asia, it is necessary for Japan to assert these rights and obligations when China in her weakness and disorganization fails to discharge her duties.

Japan's right to invoke and apply the law of self-defense may be somewhat impaired by her adhesion to the League of Nations and by other international commitments which give to other powers the right to be consulted in her disputes with China and to that extent circumscribing her liberty of independent action, but there are and always will be, circumstances which will arise to justify immediate action in applying the law of self-protection, self-defense, armed intervention and even actual warfare. There can be no controversy over the facts underlying the dispute in Manchuria and the incidents which have led up to the present situation. Whether the League is justified in intervening in a dispute arising out of the validity of a treaty extracted under duress and which the Washington Conference definitely left to be settled by the two interested parties, can be answered only by future events set in motion by this precedent. As long as the dispute in its initial stages is one which can be confined to the jurisdiction of the League, there is some excuse for its intervention, but when the larger issues are so closely related to the policies of a militant and aggressive non-member state, such intervention may result in irreparable injury to both China and Japan. No solution of the issues between these two countries can be arrived at unless China can give some acceptable guarantee that she will discharge faithfully her duties to Japan, and in her present disorganized and weakened condition, she cannot give these assurances. For the League to inject itself in such a dispute and through its action impair Japan's right to self defense, is tantamount to aligning itself on the side of Russia. Here, again, it would appear that international intervention in these Far Eastern problems is circumscribing Japan's power of resistance, binding her hand and foot while forces designed for her undoing are permitted free play. Nothing could be more unjust, nothing more conducive to a rupture of world peace, the downfall of the League and a determination on the part of Japan to go down fighting rather than meekly commit suicide.

The Washington Treaties gave China a Magna Charta and a chance to set her house in order and take her place in the family of nations on a plane of full equality and respect. As Mr. Hughes points out, "*the outside powers could not provide stability for China, but they did provide assurances of respect for her sovereignty, independence and territorial and administrative integrity and the full and most unembarrassed opportunity to develop and maintain for herself an efficient and stable government.*" Everything was done at Washington short of the interference which China resents. China was granted a full bill of rights and in being accepted into the family of nations assumed automatically certain duties inalienable to her sovereignty and essential to international intercourse. China has had ten years in which to place her house in order and discharge these obligations and duties to other states, but instead of living up to the confidence reposed in her ability to assume these burdens, she has gone from bad to worse, sinking lower and lower in the mire of militarism, lawlessness, disorder and misgovernment, until to-day she faces extinction as a state. The conditions in China have reached the point where they are intolerable, a menace to world peace and a positive danger to the existence of Japan. From being the spoiled child of the Washington Conference she has become an international torment demanding all the rights that go with sovereignty while steadily refusing to discharge her duties ; a Pandora's box of misfortunes that threaten the stability and well-being of her neighbors and the world.

Let us see how the United States acted to protect its interests in the Caribbean under similar circumstances. In 1898, the United States (even after Spain had agreed to all our demands), intervened in Cuba in the cause of humanity and because of a condition of affairs at our very door so injurious to our interests that it had become intolerable. Our action has been described by one of our foremost international legal experts as analagous to what is known in private law as "*the abatement of a nuisance.*" We fought the Spanish War to put an end to this insufferable nuisance which menaced our health and security and outraged our concepts of Humanity. It is well to recall that in the settlement, which followed the establishment of the Cuban Republic, the United States imposed a treaty upon the new state giving it the right to intervene for the preservation of its independence and the maintenance of a government adequate for the protection of life, property and individual liberty. There are also other provisions restricting Cuba's liberty to enter into treaties with other powers tending to impair her independence, and for the contracting of debts. The United States thus holds a special position in relation to Cuba, that has justified it in intervening on various occasions for the maintenance of law and order. Japan's interest in Manchuria is almost identical and for the protection of her special position and national security she has the same right to demand similar guarantees for safeguarding these interests, until such time as China is strong enough to assume the responsibilities of government in regions recognized as coming under her sovereignty.

In Santo Domingo, the United States intervened because during the forty years prior to 1907, there had been sixteen revolutionary movements followed by complete political and economic demoralization. Our armed occupation of this republic, as President Roosevelt phrased it, was "*due to the demonstration of an impotence resulting in the lessening of the ties of civilzed society and thus requiring intervention.*" And we did not withdraw from Santo Domingo until its finances were stabilized and law and order restored under a government duly created under an impartial electoral law that precluded violence and usurpation of power by the military chiefs. The United States intervened in Santo Domingo in the interests of law, order and peace and when these were assured, it was glad to withdraw. The same conditions which justified American intervention in Santo Domingo prevail in Manchuria.

The United States intervened in Hayti in 1915 after a series of successive revolutions had exhausted and devastated the republic and handed the people over to the most merciless, barbarous and bloodthirsty group of bandit *caciques* and predatory *politicos* that ever usurped the reins of government in the Western hemisphere. "The great mass of Haitians were completely at the mercy of a rapacious military oligarchy, which had exploited the people to such an extent that there was no incentive but rather a real danger in producing or in owning anything beyond the merest necessities." Compare this picture with that of Manchuria, governed by a rapacious military oligarchy which has confiscated the crops of the farmers over a period of years and circulated over six billions of worthless paper notes in payment for the seized produce. The American forces did not evacuate Hayti until law and order was restored, the power of the military bandits broken, the currency established on a firm basis and a government set up under proper electoral laws. Has Japan the right to demand the restoration of law and order in Manchuria and insist upon the withdrawal of the billions of worthless paper currency which has impoverished the country, ruined her investments and perpetuated the power of the military oligarchy ? Has Japan the right to demand the enforcement of a proper electoral law in that section of the Republic of China that will free the people from the power of their military taskmasters, establish self-government, representative institutions and the liberty of the individual ?

For similar reasons, the United States has intervened in Nicaragua, even to the point of putting down revolution by force.

Nor did we retire from Nicaragua until we had established a truly representative government under an Electoral Law that guaranteed to the harassed people their fundamental rights as citizens of a republic. It may be none of our business how the Chinese choose to govern or misgovern themselves, but the case is different with Japan in Manchuria, with an investment of nearly two billion yen dependent upon good government for adequate returns. A confiscatory system that impoverishes the people of Manchuria, also undermines the foundations of Japan's investments in that region. The Chinese military overlords, in their conception of domestic policy may feel within their rights in squeezing their own people to the point of exhaustion, but they are under obligations not to impose confiscatory regulations which indirectly destroy the value of Japanese enterprises. For that is exactly what the Chinese "system of taxation" amounts to. Disguise it, camouflage it, call it by any other name, sugar coat the pill, but "the smell of the roses hangs round it still." Confiscation it remains. The American Government nearly went to war with Mexico over confiscatory legislation designed to ruin American investments in that country. The United States refused to recognize the Mexican Government until an equitable settlement was arrived at over this issue. The predatory war-lords of Manchuria, secure in their despotic power, may resort to confiscation by indirect methods but when the system so imposed results in the general impoverishment of the people, the destruction of their purchasing power and the ruin of foreign investments, then their rapacity comes in direct conflict with the fundamental principles of international intercourse and the right acquired by Japan to equitable treatment. And when this system is responsible for the disunity of China, and the perpetuation of the rule of a military oligarchy, and the recognized government of China is powerless to discharge its international obligations, Japan has the indisputable right to defend herself against this menace to her economic welfare.

As to the right of intervention for the protection of lives and properties, it is only necessary to state that during the last hundred and fifteen years, the American Government has landed troops on foreign soil for this purpose on more than one hundred occasions. "*No nation,* says Mr. Reuben Clark (former under-secretary of state) *has with more frequency than the American Government used its military forces for the purpose of occupying temporarily parts of foreign countries in order to secure adequate safety and protection for its citizens and their properties.*" This right to intervene for the protection of lives and properties has been vigorously expressed by several of our foremost living statesmen. It is only necessary to quote from two of these statements to understand this fundamental American policy. Calvin Coolidge in his famous speech to the United Press on April 25, 1927, said :—

> "While it is well-established international law that we have no right to interfere in the purely domestic affairs of other nations in their dealings with their own citizens, it is equally well established that our Government has certain rights over and certain duties toward our own citizens and their property wherever they may be located. The person and property of a citizen are a part of the general domain of the nation, even when abroad. On the other hand, there is a distinct and binding obligation on the part of self-respecting Governments to afford protection to the persons and property of their citizens wherever they may be. This is both because it has an interest in them and because it has an obligation toward them. It would seem to be perfectly obvious that if it is wrong to murder and pillage within the confines of the United States, it is equally wrong outside our borders. The fundamental laws of justice are universal in their application. These rights go with the citizen. Wherever he goes, these duties of our Government must follow him."

Mr. Charles E. Hughes, in a series of three lectures at Princeton in May, 1928, dwelling on the fundamentals of our intervention policy in Latin America said that "*if any American President deliberately withheld protection to our nationals in time of danger, he would be condemned throughout the land.*" It is unnecessary to review other equally emphatic declarations. The American Government reserves to itself the right to apply the law of self-defense at a moment's notice and without warning, even to the extent of engaging in hostilities and intervening by armed force to protect the lives and properties of its citizens in other countries. Commenting on the right of a government to employ armed protection abroad, Raymond Leslie Buell, Research Director of the Foreign Policy Association, says :—

> .... "while states have rights they also have duties. And one of these duties is the protection of life and property against violence. This is a duty owed to other states. In municipal law when an individual is charged with failure to live up to his duties to other individuals there are tribunals which examine the charge and determine the truth. In international law such machinery has been lacking. And in the absence of such machinery the stronger states have frequently resorted to self-help when in their opinion the duty owed to them by other states has not been fulfilled .... As a result of the League of Nations Covenant and of the anti-war Pact various kinds of war have become illegal. But do these documents also make armed intervention illegal ? Commentators have argued to the contrary on the ground that armed intervention is not war. Nevertheless, he adds, there is reason to believe that under the League Covenant at least all acts of force have been placed under international control. Apart from the Covenant and the anti-war Pact, the "legality" of non political intervention, under certain circumstances, is supported not only by the practice of the leading powers, but also by the majority of the text writers on international law."

Whether the Japanese army was justified or not, in appealing to the right of self-defense on the night of September 19, can be determined only after a presentation of Japan's whole case against China. To declare that the action taken was premeditated and aggressively hostile is to lose sight of many incidents which other nations have used to justify armed intervention and actual hostilities. If the Japanese army should merely rest their case on the Nakamura incident, they have far greater provocation than that which led to the military occupation of Vera Cruz by the United States in 1914. This armed occupation of a Mexican port by the American forces was provoked by the arrest of an American warship party while loading gasoline in a forbidden military zone at Tampico. Although the men were immediately released and an apology was forthcoming from the Mexican general, the American Admiral gave him a twenty-four hour ultimatum demanding punishment of the officer who made the arrest and a 24 gun salute to the American flag. Huerta, the Mexican president, refused to punish the officer who made the arrest unless it was proven by an investigating committee that he had violated international law and asked to submit the question to the arbitration of the Hague. His request was declined by the United States. A few days afterwards another minor interference with an American mail orderly occurred in Vera Cruz, and President Wilson invoked this and the Tampico incident as a reason for asking Congress to approve the use of "*the armed forces of the United States in such ways and to such an extent as may be necessary to obtain from General Huerta and his adherants the fullest recognition of the rights and dignity of the United States.*"

The next day, a German steamer with a cargo of arms for the Mexican Government arrived at Vera Cruz, whereupon Wilson ordered Admiral Mayo to "take Vera Cruz at once." In carrying out his instructions about 200 Mexicans and twenty-one Americans were killed. President Wilson was not justified in international law in taking this summary action, but relations between the two countries had reached the point where the rights and dignity of the United States were being set at naught, and drastic action became necessary to teach the Mexican a lesson. Had an American naval officer and his party been arrested while on shore in civilian clothes and summarily executed as spies, the American forces would have never halted until an apology and indemnity were extracted in the palace of Chapultepec. This one incident is sufficient to indicate that armed occupation of foreign territory may be precipitated by incidents in time of stress that will not bear the close light of judicial investigation.

The Japanese military authorities justify their action on the night of September 19, by the blowing up of a part of the South Manchuria Railway by Chinese soldiers. In protecting the property, shots were fired which started a movement that could not be halted, until all the strategic centers in Manchuria were in Japanese hands. The Chinese declare that the Japanese manufactured the incident in order to carry out their premeditated plans for the annexation of Manchuria. Right at the outset there is a conflict of testimony that stands as a bar to any impartial verdict as to the immediate origin of the present situation. The

Japanese military officer in command at Mukden has reported how the incident of the night of September 19 started. It seems logical that if the Japanese General Staff studiously prepared the stage for military occupation of all the strategic centers of Manchuria, they would have had a much larger force on the ground than was actually there. To state that the Japanese army officers entered into a major military adventure to wrest Manchuria from China with only 10,000 guards scattered along the South Manchuria Railway line in a territory held by 250,000 well disciplined Chinese troops is improbable on its face. Such a story is not only derogatory to the pride, honor and dignity of the Chinese nation, but constitutes a charge of such sheer recklessness and audacity on the part of the Japanese military commander at Mukden that would justify his court martial and punishment. If one company of Japanese troops of 125 men can start hostilities at 11.30 p.m. surround a walled Chinese military barracks quartering 5,000 troops, hold their own until reinforced at 3.30 a.m. with four more companies and capture the barracks at 5.30 a.m. there is something decidedly wrong with the Chinese army. The Chinese contend that Japanese forces to the number of fifty thousand were engaged in the movement that took over their strategic centers in Manchuria while the Japanese assert that their troops in Manchuria on September 18, numbered only 10,400. These were subsequently reinforced by additional troops from Korea, but even then the total was still below 15,000, the maximum allowed by treaty. The Japanese statement is susceptible to proof, and in due course, will be verified by impartial observers.

The Chinese adhere to the story that it was all a put up job, premeditated in advance and carried out ruthlessly. In the interests of world peace, respect for the League and the war renunication Pact, they declined to accept the Japanese challenge, laid down their arms and refused to fight and appealed to the world to compel Japan to withdraw. They assert that Japan took advantage of their military weakness and violated every conception of humanity, honor and fair dealing. This in the face of the undisputed fact that the Manchurian armies number 400,000 men in active service (or twice the total of Japan's entire fighting force) supported by an arsenal reputed to be one of the largest in the world. Yet they gave up their arsenal and aerodrome without a struggle.

Without passing judgment on the events of September 19, it is charged that Chinese troops have on various occasions in recent months been involved in attempts to destroy the S.M.R. line interfering with traffic and in other ways goading the Japanese beyond endurance. The patience and forbearance of the Japanese under these pinpricks was mistaken by the Chinese as a recognition of their superior fighting qualities and their attitude become more and more overbearing. Since the first of the year 59 cases have occurred in which the tracks and traffic of the S.M.R. have been interfered with. In addition there were 142 cases of bandit activities along the railway. The killing of Captain Nakamura and his party by Chinese troops, now admitted by the Chinese, increased the tension to a point where any overt act would precipitate the clash.

An official inquiry to determine responsibility for the blowing up of the S.M.R. line on the night of September 18, will lead to no useful purpose. The people of the United States went to war with Spain in 1898, determined to revenge the blowing up of the battleship *Maine* in Havana harbor, yet even at this late date, we do not know how the explosion occurred. Maybe historians of the future will be able to determine who was responsible for the Great War. It will never be settled in this or the next generation. The American army captured Manila after the armistice was signed, and two shots fired by the sentries at Santa Ana Bridge, started the American army on the campaign which ended in the extinction of the Filipino Republic. Other wars have had similar insignificant beginnings. One shot was sufficient justification to start the Japanese military machine moving, yet shooting at Japanese railway patrols has become the favorite outdoor sport of bandits in Manchuria. It really makes little difference as to how the row started. We face the accomplished fact and a determination on the part of Japan to settle the Manchurian dispute once and for all time.

The Road to Unity

JAPAN'S appeal to the law of self-defense and to the right to intervene by armed force for the protection of the lives and property of her citizens while outraging Chinese sentiment and nationality can hardly be said to violate international law and practice as long as China's territorial integrity is not impaired. It is unfortunate for both countries that a dispute that might have been amicably settled has been permitted to drag along to the point where Japan has been compelled in self defense to seek a solution before she was ruined economically and defeated strategically. The facts must now be squarely faced by the governments and peoples of both nations and a fundamental settlement arrived at that will not only recognize China's full sovereignty and protect Japan's rights and investments, but draw the two nations together in a closer understanding for the defense of their common interests in a region menaced by forces that have already deprived China of a vast territory and sapped the very foundations of her national life and institutions. To approach a settlement of this problem from any other angle, is to invite disaster. A lasting settlement of the Manchurian question can be arrived at only by recognizing these basic conditions.

But there is another and more important angle to this problem that cannot now be ignored if there is to be stability and a unification of China under one strong central civilian government. The time has arrived when every dictate of Humanity demands that the military menace that has brought China to her present sad position should be destroyed. And the first step in this great humanitarian task might just as well be taken in Manchuria, through a restoration of the rights of the people and a return to fundamental economic principles. If China is ever to have a government of, by and for the people, now is the time to implant the doctrines of Dr. Sun Yat-sen in a region where, if left to traditional Chinese methods, it can only be done after years of ruthless warfare and the massacre of further millions of defenseless humanity.

The article in the August issue of *The Far Eastern Review*, entitled *"The Menace in Manchuria"* graphically describes the actual situation arising out of the confiscatory system imposed by the war-lords in compelling the farmers to sell their produce to official purchasing combinations in exchange for inconvertible paper notes. This system has been in operation over a period of years, in which time over six billion dollars in worthless paper has been foisted on the farmers in exchange for their produce, which was then sold for hard cash and the proceeds paid into the treasury of the war-lords. These paper billions are now worth about $60,000,000 silver.

This system has drained Manchuria of its wealth in order to support the armies of the military oligarchy that has usurped the power of government in the Three Eastern Provinces. The consequent impoverishment of the people and the destruction of their purchasing power has affected every line of legitimate business in the territory. The Japanese investment of nearly two billion yen is now almost valueless. When their economic foundation is undermined, their political and strategic rights will disappear in the crash that must inevitably follow.

As long as this system endures, the military autocrats of Manchuria will be provided with the funds to maintain their armies, enforce their rule over the helpless people and defy the authority of the Central Government. As long as these revenues are available to support these armies there can be no real unification under a responsible central government.

Up to last year, the Chang dynasty which holds Manchuria as its private preserve, had squeezed out of the people almost Y. 200,000,000 a year, which at the average rate of exchange is equivalent to all the legitimate revenues of the Central Government. ($450,000,000 silver). Due to this enslavement of the people and the confiscation of their produce, the Manchurian military oligarchy is therefore financially as strong as Nanking and can defy it successfully. Not until this illegitimate source of revenue is cut off can there be any hope of real unification under a central government whose jurisdiction can extend into Manchuria, and do away with the dual authority that now prevails. So, from the viewpoint of Chinese politics, this system must be abolished. Then, and only then, will the power of the Chang dynasty be broken, its armies disbanded and the people of Manchuria accorded their rights as human beings. A real basis can then be found for Chinese unity and the power of the militarists broken forever.

May not the Japanese military occupation of the strategic centers of Manchuria be utilized as the first step towards a unification that could not otherwise be attained without further disastrous civil wars ? Is it to the interests of the Chinese people or the government at Nanking for Japan to hand back the government of Manchuria to the Northeastern military group without conditions ? If she did, Japan would simply perpetuate the system that is digging her grave in Manchuria, fasten firmly the yoke of the militarists upon a defenseless people and make impossible any real unification.

If, as a condition to restoring Chinese rule in Manchuria, Japan should take the stand that the people have never been permitted a voice in the management of their own affairs ; that they have been slaves, exploited and robbed of their possessions ; that no elections have ever been held ; that the officials are merely bandit overlords who hold the "stupid people" in subjection by force ; that under the present system there is no hope for any alleviation of their sufferings or escape from their bondage and that any return to the *status quo ante* simply means the perpetuation of the system and the complete ruin of her investments ; if Japan should follow the example of the United States, declare her intention to recognize and respect the full sovereignty of China in Manchuria, and demand in the name of humanity that a stop be put to these intolerable conditions at her very door which constitute a menace to her peace, her prosperity and her security ; what answer could China or the rest of the world make to this reasonable demand.

If Japan should require as a condition to the withdrawal of her troops from the occupied cities that the people of Manchuria be first permitted to exercise their rights as citizens of the Republic of China to choose their own rulers under an Electoral Law, supervised, if necessary, by an international Commission appointed by the League of Nations, could Nanking refuse such an opportunity to liberate her people from the yoke of their military overlords, and strengthen its own position as the recognized government ? China has demanded the intervention of the League to save her from a menace from without ; will she have the moral courage to go further and admit that in so doing she confesses to her complete helplessness and inability to defend herself against outside aggression ; will she admit that her Manchurian armies are incapable of upholding her national rights and dignity in that region and request the League for aid in saving her against this menace from within ? Should Japan depart from her present rigid policy not to permit outside interference in her dispute with China over Manchuria, and call upon the League to compel China to live up to her international obligations, the League would find itself in a most embarrassing position. In the background, screened from outside observation, stands Soviet Russia over which the League can exert no influence. China is confessedly helpless to protect her own territory, defend her neutrality or discharge her obligations to Japan against "*the menace from the direction of Urga*" What answer can the League make should Japan follow China's lead and lay her case before that body ? Might it not result in the League being compelled to give Japan a free hand to protect her interests or even a mandate over Manchuria, pending the stabilization and unification of China under a strong central government ? Even if China opposed any such interference in her affairs, would not the League, in simple justice to Japan, be compelled to invite forcibly China's attention to conditions which impose upon her the faithful discharge of her obligations towards Japan ? It is one or the other. Either China must enforce her sovereignty in Mongolia and its border regions and comply with her duty to a neighbor, or invite the application of the law of self-defense on the part of the stronger power whose vital interests are placed in jeopardy by her refusal to shoulder the burden of sovereignty. Sympathy and friendship for China is one thing, but the real sentiment of the understanding world is for the Chinese people, the downtrodden slaves of their military taskmasters ; the masses whose rights, liberties and well-being were the sole thought of that great humanitarian Leader whose strength was derived from the love, affection, loyalty and trust of these masses. His principles and ideals can never take root in China until the power of the militarists are broken. The opportunity to carry out his will in Manchuria and eliminate this menace to the Chinese people now presents itself. If Nanking is wise and lives up to the wishes of Dr. Sun Yat-sen, a way can be found to settle the Manchurian dispute along lines that will cement the people of this region to the main body of China and pave the way towards that ultimate unification that will make of China a strong, prosperous and happy nation.

If Nanking rejects this opportunity and supports the Chang military oligarchy, it might just as well recognize the independence of Manchuria and be done with it.—G.B.R.

"Extracted Under Duress?"

WAS the 1915 Treaty extracted under duress ? If it is true that Japan's ultimatum of May 7, 1915, was requested by Yuan Shih-kai to "save his face" in agreeing to the demands concerning Manchuria, the contention that force was employed removes the main objection to the treaty signed on May 25, 1915, and opens a way for the honorable acceptance of its conditions.

The Publisher of *The Far Eastern Review* and his then associate (Mr. W. H. Donald) conducted China's publicity campaign against the Twenty-one Demands in 1915. The publisher of this magazine was largely instrumental in bringing the facts to the attention of the American Government officials in Washington, fighting China's battle up to the point where any further agitation would have been embarrassing to his government. On the declaration of Secretary Bryan and Mr. Lansing that the policy of the American Government was to postpone consideration of China's troubles until the whole problem of her status could be taken up at the Peace Conference or a separate international convention to be called for that purpose, his work for China could be carried no further. If the Publisher of *The Far Eastern Review*, afterwards changed his personal viewpoint on the Twenty-one Demands, it was because new facts subsequently brought to his attention threw new light on the events of 1915.

Some time after the termination of this sensational campaign, the Publisher of *The Far Eastern Review* on his return to China, called on Dr. Sun Yat-sen and rendered him a personal report of his activities in America. It came as a rude shock to be told by this great leader of New China that "*the Twenty-one Demands were a put up job ; the price that Yuan Shih-kai was willing to pay Japan for recognizing him as Emperor ; that the Ultimatum was invited by Yuan in order to conceal his treachery and save his face before the people of China.*"

The Publisher of *The Far Eastern Review* had been closely associated with Dr. Sun Yat-sen, (at one time holding his power-of-attorney) and held him in the highest esteem as a friend and a man of scrupulous integrity. He therefore accepted the above statements as the truth. On several subsequent occasions before his untimely demise, Dr. Sun Yat-sen in his quiet, but emphatic manner repeated the above statement and the writer has reason to believe that his opinions were shared by his political intimates and associates in the Kuomintang Party. It is obvious that if Dr. Sun Yat-sen knew the inside story of the Twenty-one Demands, the other leaders of the Kuomintang Party are equally cognizant of the facts.

That Dr. Sun Yat-sen told the truth is borne out by official Japanese statements. We were informed ten years ago by the highest authorities in Japan that Tsao Ju-lin, vice-minister of foreign affairs in the Yuan government, personally visited the Japanese Legation and requested Minister Hioki on behalf of Yuan to present the ultimatum.

Marquis Okuma, shortly before his death, corroborated the story in a signed statement intended for an American newspaper. Viscount Kato, who was foreign minister in the Okuma Cabinet, publicly declared in 1923, that the ultimatum was presented at the request of the Chinese Government. Nearly all the older Japanese diplomats acquainted with the inside history of the 1915 negotiations are unanimous in that the ultimatum was sent only after it was urgently requested. There would be no record of this invitation in the archives of the Chinese Government, but in the files of the Gaimusho, there is undoubtedly some proof to substantiate the statement.

Mr. Lennox Simpson, adviser to the Peking Government, in his story of the Twenty-one Demands, published in 1923, not only fully supports Dr. Sun that the Demands represented the price Yuan was willing to pay Japan for recognizing him as Emperor, but that all the details about Manchuria were agreed on long before the ultimatum was presented. Even Minister Reinsch in his official dispatches to the State Department bears witness to the fact that the Chinese were astounded and chagrined at the leniency of the ultimatum which demanded far less than they had already agreed to concede. That there was no serious opposition on the part of China to conceding the Demands relating to Manchuria is evidenced by the official records of the negotiations. As stated by Baron Shidehara at the Washington Conference, the Manchurian demands " had been virtually agreed to by the Chinese negotiators before the delivery of the ultimatum, which then seemed to the Japanese Government the only way of bringing the protracted negotiations to a speedy close"

In the face of the above statements from such unimpeachable sources, *The Far Eastern Review* has arrived at the conclusion that the real story of the Twenty-one Demands has never been told. Realizing that any further concealment of the facts would lead inevitably to a serious rupture of friendly relations between the two countries, we have on various occasions during the last decade invited attention to the evidence which in any country other than China would have brought forth an official affirmation or denial or influenced public opinion to demand an investigation to establish the facts. Unfortunately, there is no real public opinion in China and any statement or fact that would tend to clarify the events of 1915, is characterized as Japanese propaganda. No Chinese or foreign newspaper has ever invited attention to the above facts either as news or as material for editorial comment and as a consequence, the Chinese people have been maintained in blissful ignorance of evidence that completely changes the accepted version as to how the ultimatum was presented.

It is hardly to be expected that any official connected with the former Peking governments would admit the truth of any statement that reflects on their own patriotism or usefulness. The truth can be established only by those statesmen of the Kuomintang Party, who, with a fuller knowledge of Yuan's betrayal of the republic, should have the moral courage to go before the people and confess the facts. For unless the truth is revealed at this juncture, no Chinese foreign minister would dare to accept the responsibility of acknowledging the validity of Japan's rights in Manchuria under the 1915 treaties.

The recent humiliating experience of Dr. C. T. Wang at the hands of the student mob in Nanking is sufficient indication of what his successor can expect unless these matters are cleared up. In view of Japan's determination to exact compliance with the terms of the 1915 Treaty, some way must be found to save the honor and dignity of the Chinese Government when it comes to direct negotiations over pending questions. It Dr. Sun Yat-sen's statements are true, they can be substantiated from the secret records of the Kuomintang Party, and there should be no hesitancy in producing or acknowledging the evidence which throws the onus of betraying the republic on the guilty parties.

It is too late to examine the moralities of the Twenty-one Demands. The Manchurian treaty which represents only a small part of the original demands, is all that is now left of this unfortunate page in Far Eastern history. It will be difficult, even if Japan is willing, to interest the League of Nations in the revision of a treaty which will serve as the precedent for a general assault on other pacts which now form the basis of international relations. If China refuses to negotiate direct with Japan over these Manchurian issues, and insists upon carrying her case to the League, in the hope that a treaty " extracted under duress" can be vitiated or annulled by international intervention, and Japan produces evidence to show that no force was applied and that the ultimatum was requested by Yuan to save his face, she will be placed in a most embarrassing position. Her case will be ruled out of court and she will stand humiliated and disgraced before the world.

Japan, for some inscrutable reason of her own has declined to make any official statement that would unnecessarily wound Chinese susceptibilities and has meekly accepted the stigma attached to the presentation of the ultimatum, which reflects on her own honor and dignity. But if the showdown is forced by China's refusal to enter into direct negotiations, Japan, in self-defence, will be compelled to issue an official statement concerning the presentation of the ultimatum.—G.B.R.

Wanted ; A Label

WE are delighted to see that the *Japan Chronicle* is again hurling insults and abuse against *The Far Eastern Review* and its Publisher. If the Kobe disciple of Karl Marx should ever speak well of this magazine, we would have a reasonable doubt as to the sanity of our editorial conclusions and our skill in making ourselves understood. If the Churl of Naniwa-machi should ever recognize a fact or confine his editorial drivel to the evidence, instead of throwing bricks and indulging in personalities, he might restore some of the lost circulation and prestige of a newspaper that under his predecessor enjoyed the reputation of being the foremost British authority on Far Eastern affairs.

Whenever Japan is confronted with a serious international problem, the *Japan Chronicle* immediately clouds the issue with petty, trivial and undignified attacks upon Japan's good-faith and in every way endeavors to place her in the wrong. The *Japan Chronicle* has sounded the key-note in every anti-Japanese campaign that has been launched in the last two decades. Its present editor has never quite recovered from the collapse of the campaign (in which he took a most prominent part), to bring about hostilities between the United States and Japan over China. It must be very annoying and disappointing to have to report to his spiritual headquarters that his efforts along these lines have been defeated.

We wonder at times just who are the real employers of this Agent of Unrest ? Who benefits by the persistent anti-Japanese onslaughts of this insignificant, fourth-rate hold-over from old treaty port days ? What reason has the *Japan Chronicle* for existing in Japan after the cancellation of the Anglo-Japanese Alliance ? If we knew the answers to these questions, it would not be difficult to place a label on the type of propaganda disseminated by this irascible pigmy exponent of so-called " liberal ideas."

Architects and Builders Compendium

Among recent new publications that have been issued in Shanghai " The China Architects and Builders Compendium" for 1931 is particularly notable. This seventh edition of this work is edited by Messrs. J. T. W. Brooke, A.R.I.B.A. and R. W. Davis and is published by the North-China Daily News & Herald, Ltd.

For all those whose interests touch upon new construction works this book is invaluable, for it presents in the most concise manner precisely the information needed by builder, architect and contractor, dealing with such subjects as land values, land registration, consular fees, rates and taxes, water, gas and electricity supply, telephone service, building rules, professional charges and other matters having to do with building work.

The appearance of the new edition coincides with the period of the greatest building activity in Shanghai's history which continues to develop despite general world depression, increased cost of building materials and various other adverse factors. The volume includes a Directory of Architects and a catalogue of building materials.

The Steel Industry of Japan

A SURVEY

By HAROLD HUGGINS

JAPAN as an industrial nation is greatly handicapped by a dearth of raw material resources within its borders. The lack of coal and iron ore was long considered an insuperable barrier to the development of a national steel industry. But by the development of deposits in her colonies and by purchase or through financial control drawing large shipments from China and the Straits Settlements a great steel industry which is becoming more and more self-sufficing has been built up. Imports of steel materials except for the most special kinds have almost ceased. Japan to-day is preparing to enter the export markets of the Far East in competition with Europe and America.

The purpose of this survey is to show just what the Japanese steel industry consists of, just what it is doing and what it can do, and what it will probably be able to do in the future.

Iron Ore

Japan's reserves of iron ore are roughly estimated to be 40,000,000 tons (kilo).

This 40,000,000 tons is composed of:

Magnetite	19,000,000 tons
Hematite	10,000,000 ,,
Limonite	11,000,000 ,,
Total	40,000,000

These deposits are easily worked by existing methods of mining and reduction, but not with much profit to the operators. At best these ores contain not more than 55 per cent of iron. With domestic production of steel now at 1,500,000 tons a year, and steadily rising, this in not a reserve that inspires much confidence in the future.

Besides this readily worked reserve there is another 40,000,000 or more tons of low grade magnetite which may be of great value in some future emergency. But methods of refining vastly different from those now in use will have to be adopted before they can be utilized with any profit.

Much has been written and talked about the enormous iron sand deposits in Iwate Prefecture and Central Japan. Potential sources of supply they are, but so far the only results from the exploitation of the Kuji iron sand deposits by the Tokiwa Company, of Tokyo, have been repeated losses and disappointments. The iron content of the sand is low, averaging only 30 per cent, while there is a very high titanium oxide content which it is almost impossible to eliminate. The pig iron produced is only of practical value in the electric furnace. Operations have been suspended, and will probably never be resumed until some national crisis requires the supply at whatever cost.

In case of necessity there are many small deposits of iron ore in Japan which could be worked to advantage, as they were during the war years, 1914-1918. The principal deposits of iron ore now being worked in Japan are located in Iwate Prefecture and the Hokkaido. The only really important deposit in Iwate Prefecture is that at Kamaishi, owned by the Kamaishi Kozan K.K. (Kamaishi Mine Co., Ltd.), one of the Mitsui subsidiaries. The Kamaishi ore is magnetite with an average iron content of 55 per cent running to a maximum of 65 per cent.

The Kamaishi deposit is to-day estimated to contain about 14,000,000 tons. It is also estimated that there is another 40,000,000 tons of low grade ore, averaging 35 per cent iron which could be developed at need. The high grade ore is being mined to-day, but owing to the general business depression the mine is not operating at anything like the rated capacity of its mill. Several blast furnaces are now damped down.

Second in importance to the Iwate iron reserves come those in the Hokkaido. But these are of little actual value except in times of emergency. During the war-boom years, 1915-1919 they were actively worked, but to-day they are almost all abandoned. The most important of them is that at Kuttchan, near Muroran, owned by the Nihon Seiko Sho (Japan Steel Works, Ltd.) which uses the ore in its Wanishi blast furnaces. The ore is limonite containing 45 to 55 per cent of iron.

The mine at Abuta, Hokkaido, though of importance during the boom is now shut down.

To-day, 1931, there are no other iron mines in Japan which are of any industrial significance. Their only value is potential in time of need.

The iron ore reserves of Japan are given in the following table according to district:

(IN THOUSANDS OF KILO TONS)

District	*Limonite*	*Hematite*	*Magnetite*
Hokkaido	10,745	1,407	—
Iwate Prefecture..	—	1,991	16,258
Yamagata ,, ...	87	—	—
Miyagi ,, ...	—	—	72
Fukushima ,, ...	—	—	1,359
Niigata ,, ...	—	4,670	406
Gunma ,, ...	—	—	570
Hyogo ,, ...	—	—	231
Okayama ,, ...	63	—	306
Yamaguchi ,, ...	99	—	—
Kochi ,, ...	—	2,413	—
Total	10,994	10,481	18,632
Grand total	40,107		

Nara Prefecture Limonite and Magnetite .. .. 230 kilo tons
Shimane ,, Hematite and Magnetite .. .. 53 ,,
Grand total of the above: 40,390,000 tons.

There are also the iron sand deposits to be considered. These are:

Hokkaido	226,000 tons
Iwate: Kuji	143,800,000 ,,
Chugoku District ..	Not yet surveyed.
Total (surveyed only) ..	144,026,000 tons.

The foregoing figures are based on the report of M. K. Uemura, in the *Journal* of the Tokyo Geographical Society, 1928. The reserves given include ores whose iron content ranges from 30 to 40 per cent. Of these there are known:

30-40 per cent iron	3,820,000 tons
30-50 ,, ,, ...	1,103,000 ,,
35-50 ,, ,, ...	2,462,000 ,,
40-40 ,, ,, ...	173,000 ,,
45-50 ,, ,, ...	1,313,000 ,,
Total	8,871,000 tons

It this be deducted from the total above given, 40,390,000 tons, there is only a balance of 31,519,000 kilo tons of ore containing more than 50 per cent of iron left in Japan. The iron sand deposits in the Hokkaido and Iwate Prefecture contain about 30 per cent iron: those of Chugoku, from 40 to 50 per cent.

It can readily be seen from these figures that for a country having a steel industry producing from 1,500,000 to 2,000,000 tons of finished steel a year, and with a domestic demand for 2,500,000 tons a year at the present time, Japan's iron ore reserves are far from being sufficient to warrant undue optimism about the future of an industry dependent on them alone. And this is saying nothing of the military disadvantages such a condition exposes. Dire necessity therefore forces Japan to look elsewhere for its essential supply of iron ore.

First of all the Japanese colonies and dependencies must be considered.

Taiwan

Formosa (Taiwan) is, so far as present surveys indicate, barren of iron resources.

Chosen

Korea (Chosen) supplies to-day about one-third of Japan's total imports of iron ore.

The iron deposits in Chosen are located in the northwest near the coast. Limonite predominates, the principal supplies containing from 50 to 55 per cent iron. Hematite is also mined, the ores having about the same iron content as the limonite.

The known reserves of iron ore in Chosen total 4,838,000 tons, but there are others variously reported at 10,000,000 to 20,000,000 tons. No accurate survey has yet been made but with present day production only a little short of 500,000 tons a year, the known supplies are hardly sufficient to last a decade.

The Mitsubishi Seitetsu K.K.'s (Mitsubishi Steel Co., Ltd.) steel works at Kenjiho, Chosen, use limonite from mines at Kenjiho, Genzan and Nanyo. The Nihon Seiko Sho K.K. (Japan Steel Works, Ltd.) operating at Muroran, Hokkaido, obtains the greater part of its ore from the mines it ownes in Heian Nando, Chosen. This ore is also limonite. Carried by sea to Muroran, it is smelted together with that from the company's own mine at Kuttchan.

The Government General of Chosen owns a mine at Sainei, Hokkaido, which is operated by the Mitsubishi Steel Co., Ltd. Some of the ore from this mine is sold to the Yawata Steel Works.

The Yawata Steel Works also buys ore from the Rigen Iron Mine Co., Ltd., which owns a deposit of hematite estimated at 10,000,000 tons. This ore has an iron content of 50 to 55 per cent. This company also supplies several of the private companies making pig iron in Japan.

Iron ore reserves of Chosen :

Location	*Kind of Ore*	*Ore Reserves*
Kaisen	Limonite	1,000,000 kilo tons
Inritsu	,,	1,130,000 ,,
Sainei	,,	1,890,000 ,,
Angaku	Hematite	370,000 ,,
Koshu	Limonite	848,000 ,,
Kaishu	,,	600,000 ,,
Inritsu	,,	Not yet known
Sainei	,,	,,
Kosei, Kimpo Heinando	,,	,,
Rigen, Hokusei, Kankyo Nando,	Hematite	10,000,000 kilo tons (estimated)

The reserves in Chosen so far as surveyed being only sufficient for the requirements of a growing steel industry for a decade or two if no other sources of supply had been discovered in the Japanese Empire, would have added little to the future development of the Japanese steel industry.

Fortunately there is South Manchuria.

South Manchuria

In South Manchuria, Japan seems to have obtained a supply of iron ore which will last for many generations if low-grade ore can be handled with profit.

The South Manchurian deposits are very large, but less than 5,000,000 tons of high grade ores have been discovered, and in these deposits the ore occurs mixed with low grade ores containing only 34-36 per cent of iron, and a very high percentage of SiO_2. The cost of handling this low grade ore is an unsurmountable obstacle to its economical use to-day. The Manchurian ore deposits are, however, being developed through the use of reduction furnaces specially adapted to handle low grade ore. Good coal for coking is found in the vicinity of the iron mine near the blast furnaces.

This being the situation as regards iron ore in Manchuria, Japan can not expect to meet its deficit ore by imports from Manchuria huge as the reserves there are. Manchuria economically can only supply Japan with pig iron. And with this intent the great plans of the Showa Seitetsu K.K. (Showa Steel Works, Ltd.) a subsidiary of the South Manchuria Railway Co., Ltd., have been adopted. Mining in Manchuria is open-cut work so mining operations are very simple and labor costs are low. But Manchurian pig iron, nevertheless, because of the long distance it must move to market in Japan, and because of the export tax in China and the import tax in Japan, is not cheaper than that made in the domestic mills.

The South Manchuria ore reserves are estimated at :

Province :	*Ore Reserves*
Kungchangling	268,000,000 tons (kilo)
Penhsihu	70,000,000 ,,
Anshan	400,000,000 ,,
Total	738,000,000

Other estimates put the Manchurian reserves at only 290,000,000 tons, with an iron content of 110,000,000 tons.

Total Ore Reserves

Of readily workable ore Japan has only about 65,000,000 tons; if the Manchurian supplies be taken at 738,000,000 tons this figure is considerably exceeded, but before taking the Manchurian deposits at anything like this figure the low iron content of the ores, and the difficulties of reducing them must be taken into consideration. Estimating the Manchurian resources at the lower figure given before, 290,000,000 tons, there is still a very great addition to be made to the reserves of the empire. But all in all these reserves are of problematic value, and it is essential that Japan look elsewhere for its actual present day supplies, and the supplies for the immediate future of its growing steel industry.

Imports (their Necessity)

From the facts here given it follows that imports of iron ore, as distinct from imports from Chosen and Manchuria, are of supreme importance to the Japanese steel industry, and to the Japanese nation.

Any source of iron ore which Japan acquires must primarily be capable of protection in case of war. It must therefore be located in some nearby nation whose trade route to Japan could be protected by the Japanese navy. China then becomes the principal potential soure of supply. In recent years, of almost equal importance with the Chinese ores, are the imports from Johore and Trenggenau, in the Straits Settlements. From China and the Malay Peninsula, Japan now imports more than 1,000,000 tons of iron ore a year, and is preparing to import increasing quantities as the years go by.

China

Chinese ores are high grade hematite, and they are exported to Japan from the provinces of Hupeh and Anhwei in the Yangtze Valley.

In Hupeh Province the Han-yeh-ping Company owns the Tayei mine. Its estimated reserve is over 10,000,000 tons of hematite averaging about 60 per cent iron.

In Anhwei Province the Tai Ping and Toa Chung mines are located. From both these mines large shipments of ore are made to Japan every year. The Tao Chung mine has a reserve of 3,750,000 tons of hematite, grading 60 per cent iron content. This mine is owned by the Yu-han Co., which has been financed by the Toyo Seitetsu K.K. (Oriental Steel Works, Ltd.) through a subsidiary known as the Nikka Kogyo K.K. (Sino-Japanese Industrial Co., Ltd.) A loan of Y.2,500,000 was made to this company in return for which the Toyo Seitetsu obtained a contract of privilege to buy up to 500,000 tons of ore a year at a material reduction from the prevailing price figures. This contract is now leased to the Yawata Steel Works along with the mill of the Toyo Seitetsu K.K.

Near Nanking the Moling-kuan mine is operating with funds advanced by Okura & Co., Tokyo.

The Tayeh mine is developed to such an extent that in case of demand, it can supply Japan with 600,000 tons of ore annually. The reserves of the Province of Hupeh in which this mine is situated are estimated at 35,000,000 tons.

In Shantung, the Ching-ling-hung mine is operated by Japanese interests. This mine is said to have a reserve of 55 per cent hematite amounting to 14,000,000 tons.

These are the Chinese sources of iron ore intended for Japan. All the companies operating are either controlled by Japanese through capital investment or through loans. In China, Japan has thus obtained a *controlled* iron ore reserve as follows :

Mine :	*Ore Reserves :*
Tayeh Mine	10,000,000 kilo tons
Anhwei Province :	
Tai Ping and Tao Chung ..	6,000,000 ,,
Moling-kuan	5,000,000 ,,
Ching-ling-chang	14,000,000 ,,
Total	35,000,000 tons (kilo)

This is almost equal to the reserves in Japan proper.

But it has long been known that the domestic, colonial and Chinese reserves are not sufficient in themselves for Japan's developing needs for steel.

Since the war boom much attention has been paid to the iron ore reserves in the Straits Settlements and Malay States. These are of growing importance to Japan.

Straits Settlements

The Nanyo Koshi, a Japanese company, owns a concession in Johore, from which it has mined in one year more than 400,000 tons of high grade hematite to ship to Japan. The ore is very abundant.

In 1927, the Kuhara Mining Co., now known as the Nihon Sangyo K.K. (Japan Products Co., Ltd.) obtained a lease of iron mines in Trenggenau, which have an estimated reserve of 40,000,000 tons of hematite, with 58 to 66 per cent iron content. All the ore mined is bought by the Yawata Steel Works.

The iron ore reserves which Japan controls in the Malay Peninsula are estimated at about 75,000,000 kilo tons. This ore is delivered in Japan to-day at about Y.9 a ton. Considering its high iron content this price is very low. The ore is shipped to Japan on special vessels owned by the Nanyo Koshi and the Yawata Steel Works, so transportation charges are at a minimum.

The increase in the supply of ore from Johore and Trenggenau has been so rapid and spectacular that many other interests are seeking concessions there. The Japanese consider that territory safe to develop, and it is more than probable that in the near future the number of concessions will be added to, and shipments of ore materially increased every year.

Japan's Total Reserves

Despite its very poor iron ore resources, by diligent efforts Japan has managed to get under its control in the Far East a total of more than 900,000,000 tons of iron ore, as follows :

Chosen	20,000,000 kilo tons
South Manchuria	738,000,000 ,,
China	35,000,000 ,,
Straits Settlements	75,000,000 ,,
Total	868,000,000 kilo tons

This makes quite a respectable showing for a nation which can only show 40,000,000 tons at best within its own borders. Adding this 40,000,000 tons to the amounts above, the total of Japan's potential resources reaches 908,000,000 tons. However, if the Manchurian reserves are taken at the lower figure given before, 290,000,000 tons, this total is reduced to 420,000,000 tons, still a very respectable figure. Perhaps a figure somewhere between these two would represent the actual state of affairs.

To keep a reserve supply on hand at Yawata Steel Works, which is the center of the Japanese steel industry is the constant endeavor of the authorities concerned. It is reported that to-day's reserve of ore stored is a minimum of two years supply. Great extensions have recently been made to storage space, and improvements in unloading and handling equipment have brought down the cost of ore used in the blast furnaces very materially in the last year.

Imports of Iron Ore

The following table shows imports of iron ore and countries of origin from 1912 to 1929, inclusive. The 1930 imports by countries of origin are not yet officially known ; in all probability they are in very close proportion to the imports in 1929.

IMPORTS OF IRON ORE. (IN KILO TONS.)

Year	*China*	*Straits*	*Other*	*Total*	*Chosen*	*Grand Total*
1912	195,625	—	2,586	198,211	123,405	321,616
1913	277,883	—	2,013	279,896	142,420	422,316
1914	297,183	—	1,685	298,868	162,044	460,912
1915	308,074	—	714	308,788	201,978	510,766
1916	279,216	—	575	279,791	190,225	470,016
1917	295,688	—	1,193	296,881	120,907	417,788
1918	359,698	—	1,232	360,930	236,611	597,541
1919	595,140	—	25,946	621,086	333,521	954,007
1920	650,527	—	11,841	662,368	332,533	994,901
1921	439,769	—	138,287	678,056	190,541	768,597
1922	644,730	—	173,780	818,510	89,827	908,337
1923	661,796	163,441	68,023	893,260	95,390	988,650
1924	810,157	264,933	42	1,065,132	136,727	1,201,859
1925	813,490	290,213	6	1,103,709	107,868	1,211,577
1926	502,747	290,053	30	792,830	98,992	891,822
1927	502,597	434,837	54	937,488	168,764	1,106,252
1928	877,841	738,502	631	1,616,974	225,389	1,842,363
1929	950,303	958,619	35,864	1,944,786	314,134	2,258,920
1930	Not yet reported :			1,959,278	not yet reported	

(The foregoing table is taken from *Seitetsu Gyo Sanko Shiryo* published by the Mining Bureau of the Department of Commerce and Industry, June, 1930.)

This table shows comprehensively how there has been no advance in the production of iron ore in Chosen since 1920, the year the war boom ended. Ore from China then became cheaper than ore from the colonial possessions, and it was better ore too. Attention then was given to improving imports and increasing them. This was done by the development of the concessions held in the Malay States. The steady advance of this import can be noted from 1923. Before 1923, imports from the Malay States are concealed under the heading "others," but something of their volume can be understood from the great decline in "Others," as soon as imports from the Malay States were separately given. Since 1923, the increase in volume of these imports has been 486 per cent ; the increase in imports from China during the same years has been only 43 per cent. This slight increase in volume of ore imports from China is partly due to disturbed political conditions there. But the Malay States ores are in great favor, and assay at higher iron values than Chinese ores.

Certainly the whole future of the Japanese steel industry is completely bound up with development of the iron ore deposits of China and the Straits Settlements.

How extremely insignificant the Japanese domestic production of iron ore really is, can be seen in the following table, from the same source as the table of imports.

PRODUCTION OF IRON ORE : JAPAN PROPER. (KILO TONS.)

1912 ...	... 152,983	1921 ...	... 86,977
1913 ...	... 153,101	1922 ...	... 39,744
1914 ...	... 121,636	1923 ...	... 55,174
1915 ...	... 118,955	1924 ...	... 57,922
1916 ...	... 139,953	1925 ...	... 75,765
1917 ...	... 267,594	1926 ...	... 130,420
1918 ...	... 378,114	1927 ...	... 159,005
1919 ...	... 362,949	1928 ...	... 157,706
1920 ...	... 314,858	1929 ...	... 177,556

Production in Japan proper is, of course, not absolutely neglected, but in comparison with the increase in imports since 1920, there has been an actual falling off in the volume of ore mined in Japan of 43 per cent (up to the end of 1929 and probably a greater decline by the end of 1930).

Iron ore mined in the Japanese possessions is shown in the next table (same source as the two foregoing tables).

(Kilo Tons)

Year	*Chosen*	*Manchuria*	*Total*
1912	122,503	not reported	122,503
1913	149,049	,,	149,049
1914	182,034	,,	182,034
1915	209,937	,,	209,937
1916	245,418	,,	245,418
1917	152,933	103,146	256,079
1918	430,787	186,357	617,144

Year	*Chosen*	*Manchuria*	*Total*
1919	417,000	263,865	680,865
1920	447,249	175,966	623,215
1921	232,692	206,243	438,935
1922	185,584	140,128	325,712
1923	306,255	213,731	519,986
1924	323,636	220,384	544,020
1925	376,207	220,999	597,206
1926	387,717	566,543	954,260
1927	422,560	530,604	1,053,164
1928	559,331	673,624	1,232,955
1929	559,218	781,258	1,340,476

The amount mined in Chosen is almost double the amount of ore shipped to Japan. The ore is used in the Mitsubishi Steel and Iron Works at its plant in Kenjiho. The entire ore output of Manchuria is consumed in Manchuria, and the pig iron produced is shipped principally to Japan.

Consolidating the three tables before given, the total ore supply of Japan for the years 1912-1929, inclusive, was:

(Kilo Tons)

Year	*Imports*	*Domestic*	*Chosen and Manchuria*	*Total*
1912	198,211	152,983	122,503	473,697
1913	279,896	153,101	142,049	575,046
1914	298,868	121,636	182,034	602,538
1915	308,788	118,955	209,937	637,680
1916	279,791	139,953	245,418	665,162
1917	296,881	267,594	256,079	820,554
1918	360,930	378,114	617,144	1,356,188
1919	621,086	362,949	580,865	1,664,900
1920	662,368	314,858	623,215	1,600,441
1921	578,056	86,977	438,935	1,103,968
1922	818,510	39,744	325,712	1,183,966
1923	893,260	55,174	519,986	1,468,420
1924	1,065,132	57,922	544,020	1,667,074
1925	1,103,709	75,765	597,206	1,776,680
1926	792,830	130,420	954,260	1,877,510
1927	937,488	159,005	1,053,164	2,149,657
1928	1,616,974	157,706	1,232,955	3,007,635
1929	1,944,786	177,556	1,340,476	3,462,818

Considering the total supply of iron ore, the Japanese Empire has been able to supply only about half of the needs of the national steel industry. But this total includes the rather large production of Manchuria, which since 1917 has been as follows:

IRON ORE PRODUCTION IN MANCHURIA. *(kilo tons)*

Year	*Quantity*	*Year*	*Quantity*
1917 ...	... 103,146	1924 ...	... 220,384
1918 ...	... 186,347	1925 ...	... 220,999
1919 ...	... 263,865	1926 ...	... 566,543
1920 ...	... 175,966	1927 ...	... 630,604
1921 ...	... 206,243	1928 ...	... 673,624
1922 ...	... 140,128	1929 ...	... 781,258
1923 ...	... 213,731		

The Manchurian ore is not exported and therefore it does not alleviate the dearth of a national supply to help develop a self-sufficing steel industry in Japan. Pig iron from Manchuria must pay both export duty from China and import duty into Japan, so it does not arrive in Japan at a price which makes it particularly attractive to steel makers. The development of the pig iron industry in Manchuria is also not particularly welcomed by the Japanese makers, and a finished steel industy there causes them much uneasiness.

The next table shows the percentage of imports, domestic production, and imports from Manchuria and Chosen, in the total supply of iron ore of the Japanese Empire:

Year	*Imports per cent*	*Domestic Production per cent*	*Manchuria and Chosen per cent*
1912	41.8	32.3	31.3
1917	36.1	32.6	31.3
1919	37.3	21.8	41.9
1920	41.3	19.6	39.1
1924	63.8	3.4	32.8
1927	43.6	7.4	49
1929	56.1	5.1	38.8

In explanation it may be said that 1912 may well be taken as the beginning of the Japanese steel industry on anything like a large scale. In 1917 most of the ambitious projects organized to profit from the war boom were begun, and in 1918 and 1919, there was feverish activity in steel in Japan, every effort being made to start up new concerns with large blast furnaces and equipment for manufacturing all commodites of which the nation was being starved by the dearth of shipments from Europe and America. 1919 saw the height of the war boom, 1920, the end of the boom, and the beginning of years of difficulties for all steel makers. In 1924 there was some slight improvement because of demand for materials in the earthquake—and fire—devastated Kwanto. In 1926 the Government's plans to establish a self-sufficing national steel industry were definitely settled and put into effect, so that in 1927 the first year after customs duties were increased and subsidies granted to the domestic pig iron makers, there was a great advance in the production of all kinds of steel products in Japan. In 1929, product reached its highest figures. In 1930 there was a slight falling off in production from 1929. Perhaps the most noticeable thing about these figures is the rise in the Japanese industry since 1926.

Costs of Iron Ore

Nothing very definite can be learned about iron ore costs, but in 1930 they were as follows: (estimated)

Domestic Ore	Y. 8.00	per ton
Chinese ores :	Y. 9.00	,,
Straits ores	Y. 9.00	,,
Chosen Ore	Y. 7.50	,,

These are not very definite figures, but it is rather definite that the mixture of ore used in the blast furnace at the Yawata Steel Works, costs from Y.11 to Y.15 per ton of pig iron produced. Though in all probability the Yawata costs are nearer Y.15 a ton than Y.11.

Ore delivered to the Yawata Steel Works is transported entirely by water, and is delivered directly to the works without other handling. Freight rates are very low, and particularly on ores from Johore and Trengganau.

The reason that ores from China and the Straits Settlements can be imported by Japan at such low costs, is because of low labor wages in those countries. If there should be any great increase in this item of cost in these countries, the Japanese steel industry would be almost fatally affected.

Coal

The greatest handicap Japan faces in the development of the national steel industry is the lack of satisfactory coal at prices which are anything comparable to those at which the European and American steel industries obtain quite adequate supplies. It is generally conceded that the price of coal in Japan is more than twice what it is in other steel producing countries of the world. It is exactly in this item of high priced coal that the Japanese industry was unable to face foreign competition until customs duties were raised to cover the differences in costs.

Japanese coal is not only expensive, it is also not good coking coal. Reserves are large, and are more or less variously estimated at anything from 5,000,000,000 to 10,000,000,000 tons.

COAL RESERVES OF JAPAN, CHOSEN AND MANCHURIA

(Millions of kilo tons.)

Location	*Surveyed*			*Probable*			*Total*
	Anthracite	*Bituminous*	*Lignite*	*Anthracite*	*Bituminous*	*Lignite*	—
Karafuto	—	17	—	—	1,345	—	1,362
Hokkaido	—	336	—	—	2,106	233	2,675
Kyushu	—	542	—	—	2,374	—	2,916
Other	5	—	67	57	409	478	1,007
Total	5	896	67	57	6,234	711	7,790
Chosen	7	1	5	33	13	22	81
Manchuria	—	409	—	68	731	—	1,208
Total	12	1,306	72	158	6,978	733	9,259

(*Imperial Geological Survey* compilation.)

Because suitable coking coal is lacking in Japan, particularly in the near vicinity of the Yawata Steel Works, a considerable import of Fushun coal is made from Manchuria. This is used particularly at the Yawata Steel Works for making coke. The Kailan Mining Administration of China, also supplies the Yawata Steel Works with about 250,000 tons of coal a year from its mines.

Strange to say, Japan is a coal exporting country. One would naturally suppose then that coal in Japan is cheap. The exports, however, are of the lowest grades, not suitable for use in the steel industry.

Not only is the development of the steel industry much handicapped because of the high cost of coal in Japan, but the development of all power using industries is being badly restricted because of this high cost. It is almost definite now that hydro-electric power will not sell at a lower price than steam generated power. And yet the policy of the Department of Communications in charge of electrical developments is to restrict licenses for the construction or expansion of steam power stations. There is, to-day in Japan, a surplus of high-cost hydro-electric power, and a dearth of low-cost steam-electric power.

Coal suitable for coking is found in the Hokkaido. The Nihon Seikosho K.K. uses this coal in its works at Muroran. The Yubari mine owned by the Mitsui Kozan K.K. (Mitsui Mine Co., Ltd.) produces about 1,000,000 tons a year.

The Yawata Steel Works uses coal from mines which it owns, the most important of these being located at Futase, in Fukuoka Prefecture, and at Shika Machi, Nagasaki Prefecture. They supply about half the coal used in the steel works coke ovens. These works buy a small amount of coal from the Miike coal mine owned by the Mitsui Mine Co. The balance needed comes from Fushun and Kailan in China.

Not only are coal prices higher in Japan than in any other steel producing country of the world, but production per man employed is lower. The mines are far from being easily or inexpensively worked. The main veins on the main-island and in Kyushu are comparatively thin, though there are said to be some seams 60 feet thick, in Karafuto.

At the Yawata Steel Works from 1.6 to 1.8 tons of coal are consumed to produce one ton of coke. The coal used at Yawata to-day averages in price from Y. 7.50 to Y. 9.00 a ton. This makes the coking cost per ton from Y. 12 to Y. 16.20; the lower estimate is an extremely optimistic one, and the higher estimate is probably a bit under the actual maximum cost to-day.

Steel works in Japan have been located at points where coal has been considered cheap, and where ore could be delivered at a minimum handling charge. But coal has never reached a price sufficiently low to make steel production economically profitable in competition with imports. The customs duties alone made competition possible, and finally have made it impossible for imports to compete. This condition has been brought about since 1926. Plans for the future are even more severe on imports.

It has been by raising customs duties, and by subsidies to manufacturers, that the Japanese steel industry is now slowly ousting foreign steel from the Japanese market. To make Japan self-sufficient in iron and in steel is a national ambition—a necessity from the military point of view. How far this has been accomplished will be shown in later sections of this survey.

No matter how far the industry has been developed under these conditions, the fact remains that supplies of both iron ore and coking coal are inadequate for the growing needs of the developing industry. So far as iron ore is concerned it may be taken for granted after considering the figures here given that the question of ore supply is one that no longer precludes the satisfactory development of the Japanese steel industry. It is fortunate for Japan that the Malay Peninsula supply of ore is not needed for the development of a national industry in Johore or in Trengganau. For these reserves are of the utmost importance to Japan, because of their high iron content, and their availability to the market.

The Japanese ambition has been to stop all imports of steel. But to-day this has been slightly modified. About one-tenth to one-eighth of the annual requirements are more economically imported. So makers and officials concerned with the steel industry now say "let the importer flourish on these items—if he can." These items are:

Special steels
Sheets and plates—certain sizes and thicknesses of
Tubes, small sizes only.

Complete independence would require an industry newly equipped to supply at least 2,500,000 to 3,000,000 tons a year for the next few years. In the present condition of industry it would be difficult without absolute government support to find the money for any such extensions and improvements. The Japanese steel industry in point of fact needs to improve its existing equipment and methods of production before it increases its productive capacity.

A very creditable grade of steel is produced in most of the Japanese mills, but equipment is old and far from economical to operate. But any bettering of present conditions in the individual mills can only come from one of three causes:

1. More money to spend by increasing capital or by borrowing.
2. A general merger of all steel companies and the Yawata Steel Works.
3. Elimination of all the uneconomical plants by letting them go into bankruptcy. This would permit concentrating all funds for improvements on the really efficient companies and the Government steel works.

The second cause outlined above, much as it is advocated, and prayed for by the private makers, will not be effected this year as expected, and it probably never will be. More money to improve equipment will probably be available by borrowing from the banks which are eager for any trustworthy investment for their enormous surplus funds. However, the steel companies are not exactly favored concerns, though the Nihon Kotsan K.K. has succeeded in re-issuing its Y.9,000,000 debenture issue, due in May this year, at not two severe terms.

(To be continued)

Paper from the Mulberry Tree

Dr. S. Kawasé, Professor in the Faculty of Agriculture in the Tokyo Imperial University, who is an authority on vegetable fibres, has succeeded in making paper from the mulberry tree. Mulberry bark, he says, has been used for Japanese paper-making in the past, but too much time and trouble had to be taken for stripping off the bark, which was a great obstacle to success. But he has succeeded in using for paper-making, not only the bark, but the trunk and branches. This paper is very tough, and best fitted for silkworm-bed paper, not to mention packing, wrapping, envelope, wall and other papers. The paper is not yet pure white, but may be made so sooner or later, when it may serve as a substitute for esparto paper, a famous high class printing paper; for it resembles closely that paper in fibre. In that event, a remarkable renovation may be introduced in the Japanese printing world.

Regarding supply of the material, the total acreage of mulberry gardens in Japan extended over 620,000 *chobu* in 1929, and the average amount lopped off for feeding the silkworms is 300 *kwammé* per *tanbu*, of which 150 *kwammé* is twigs and 150 *kwammé* leaves and sprays. The twigs when dried are reduced one-half, or to 75 *kwammé*. The annual yield amounts to 465,000,000 *kwammé*, or 1,720,000 tons. If this amount be applied to making paper, the demand for paper in Japan could be covered entirely by it, and there would be even too much to be exported. The yearly output of foreign paper in Japan comes to Y.150,000,000 in value; but when mulberry paper is used, it will increase to upwards of Y.200,000,000. If it is impossible to use all the mulberry for this object, at least one-third could be used.

Statistics for 1929 show that the yearly consumption of wood in Karafuto by Japanese paper mills amounts to 8,500,000 *koku*, or 1,100,000 tons. Mulberry twigs are produced yearly to the amount of 1,720,000 tons, and are available for nothing but fuel among the farmers. Reforestation in Karafuto after the yearly deforestation will not restore the forests to the former state even within thirty years; and if neglected, the forests would eventually become treeless. The mulberry trees grow yearly as much as the deforestation for paper material goes on; so their supply is almost inexhaustible. The making of paper from mulberry would, therefore, be very promising for maintaining the national wealth as well as for relieving the agricultural villages.

Long Distance Telephone Service Now Links Hongkong and Canton

A NEW era of rapid telephone communication in China began on September 1, when long distance telephone service was established between the cities of Hongkong and Canton. This was made possible through the progressiveness of the Hongkong Telephone Company, Ltd. and the Canton Municipal Telephone Administration. The new service was formally inaugurated by Sir William Peel, Governor of Hongkong, calling Mr. Lin Yun-koy, Chairman of the Kwangtung Provincial Government. A feature of the ceremony was the sending of pictures and facsimiles of documents including Chinese characters by means of telephoto apparatus. Demonstrations were also conducted showing the operation of combination—sending and receiving teleprinters whereby messages were typed on one end and simultaneously transmitted to and recorded on the other end.

General view of Mountain Country through which the Cable Runs

The service is rendered through a specially designed lead covered and steel taped armored cable which was placed underground along the entire route in order to minimize the possibilities of interruption due to atmospheric conditions or other external forces. Both managements realized that to furnish an absolutely dependable service it was necessary to place the cables underground throughout practically its entire course. The operating practice is based on the most modern long distance traffic methods, the key note of which is the completion of calls on a no-delay basis while the subscriber waits on the line.

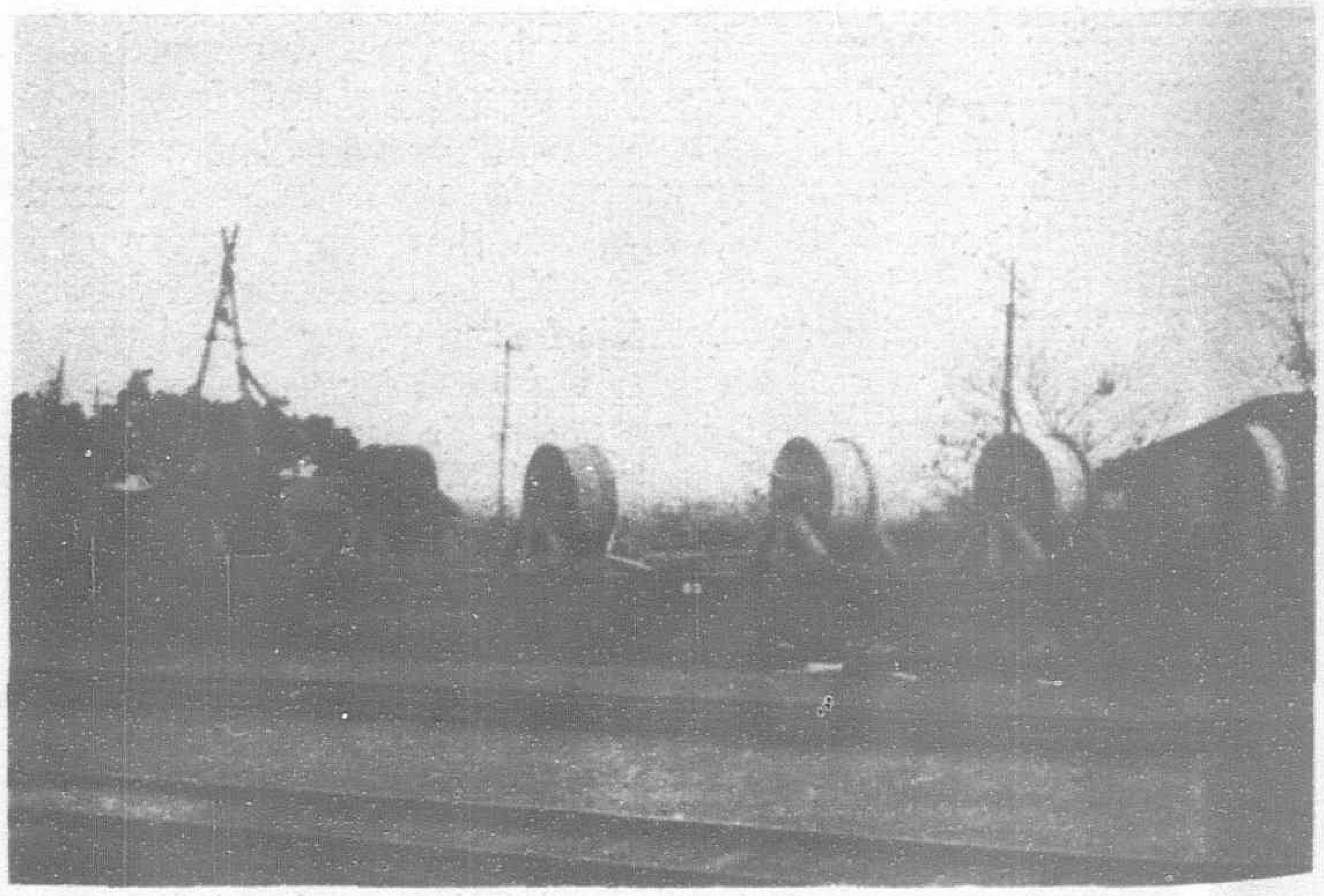
The cable consists of 20 pairs of wires in 10 quads and provides 20 physical circuits and 10 phantom circuits over which 30 conversations may be held simultaneously. Although the cities are situated only 85 miles apart (air line measurements) the actual length of the cable is about 120 miles due to the nature of the country traversed and the need for a protected right-of-way. The design of the cable is such that for the greater part of the route it was placed in a trench about two feet deep without using any special conduit protection.

The route from Canton runs through various types of country including low swampy land, rocky mountainous country, river crossings, a railway tunnel and finally across the harbor from Kowloon to Hongkong. The work of laying the cable commenced from the Canton end on January 17, 1931, and was completed on August 10. After leaving Canton the route follows the railroad for the greater part of the distance. A special train was utilized in those parts to transport the cable, the laying of which was done mostly at night directly from the drums mounted on railway cars.

When long water crossings were encountered, some of which were in excess of 1,000 feet, junk boats were employed to carry the cable across. The cable sections at those points were constructed of special wire armor for submarine protection. Floods frequently interrupted the progress of the job. In many cases the cable had to be raised above the ground in order to make the splices (joints) as it was important that the inside of the cable be kept dry. Several times splices were made under difficult conditions three feet below flood level. Work had to be temporarily abandoned on several occasions due to high water conditions. The submarine cable which crosses the harbor from Kowloon to Hongkong is about 1.2 miles long. This section of the cable was fabricated and shipped in one length thereby eliminating the necessity for making splices and also permitting the cable to be laid directly into position.

The testing and splicing work which was, perhaps, the most important features in the successful completion of the job followed closely upon the laying of each section. Each length of cable was tested to ascertain its electrical characteristics and several lengths were then joined together to form sections about 1.2 miles long. When these sections were completed, dried air under pressure was applied in order to make sure that both the cable and splices were air-tight. The next operation was the placing of loading coils in a sealed case in a concrete man-hole at the end of

Pulling in First Length of Cable in Canton



Cable Tram ready for Night Laying

A Joining Squad at Work

Turning a Cable Drum in Streets of Canton

each section and, after further tests, joining the several sections together through the loading coils so as to produce continuously balanced circuits.

The cable for the project and the special switch-board equipment on the Canton end were supplied and installed by the China Electric Company, a subsidiary of the International Telephone and Telegraph Corporation which is also the parent company of the Shanghai Telephone Company. The cable, teleprinters and telephoto apparatus were manufactured by companies also associated with the International Telephone and Telegraph Corporation.

Transmits Pictures

Following opening of the new Hongkong-Canton telephone service the mode of transferring photographs and documents as described in the *Hongkong Weekly Press* is as follows:

The photograph or document is inserted in the transmitting apparatus and the current switched on. The matter to be sent is affixed to a drum which slowly revolves. An intensified light beam is directed on to the picture and the reflected light from this beam affects a photo electric valve which controls the current to be passed out to the line after amplification. At the receiving end the received current is again amplified and passed through coils which affect the movements of a small suspended magnet upon which is fixed a mirror.

The reflections from this mirror are transmitted through lenses to sensitized paper or a film. The vibrations on the mirror are, of course, in complete accord with the vibrations or varied reflections of light caused at the sending end by the light and shade on the item being transmitted.

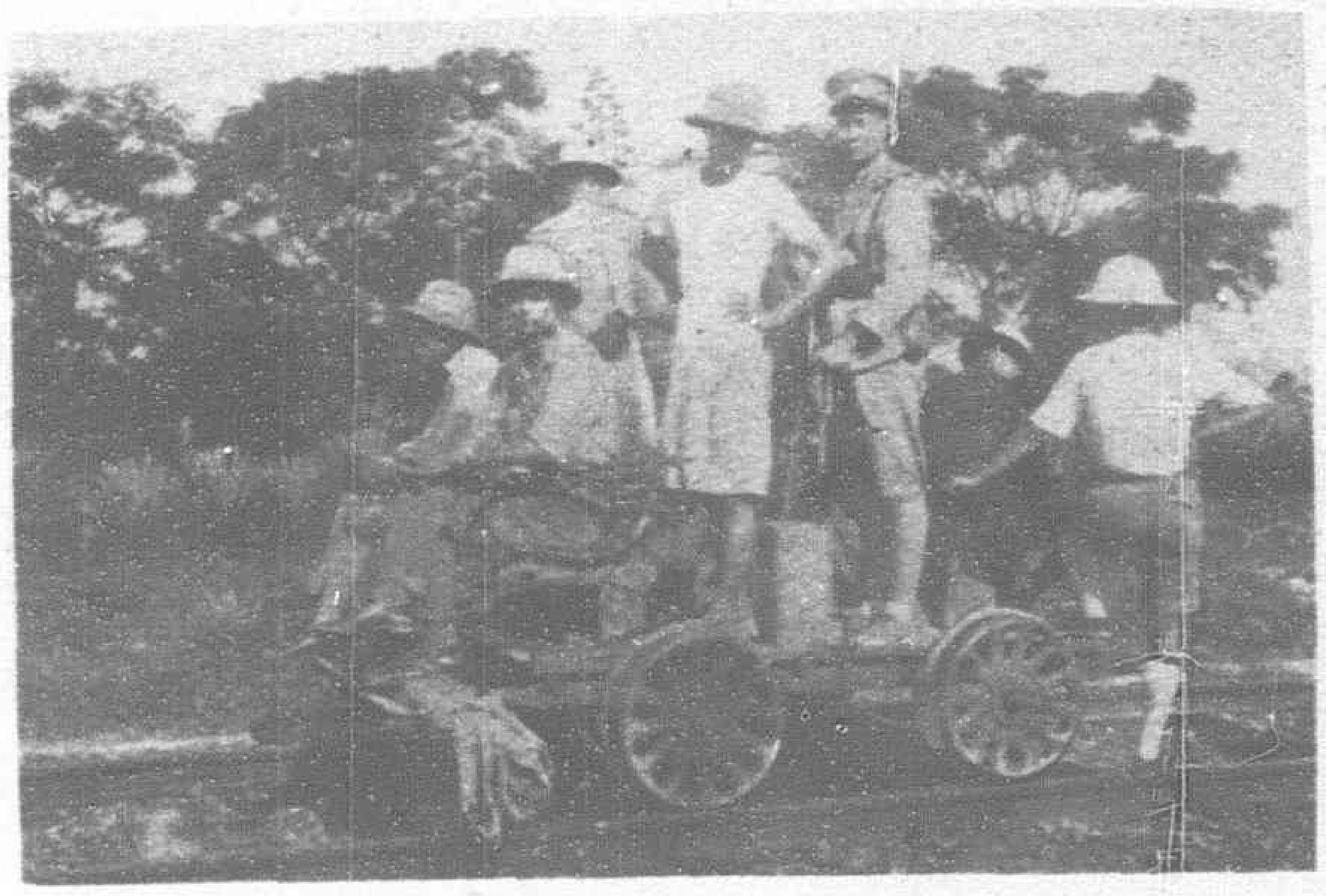
A number of photographs and letters have been transmitted already over the line, and the reproduction is perfect.

The teleprinter is, in effect, a distant typewriter. The demonstration model fitted in the offices of the Telephone Company is connected by wires in the toll cable to another one in the offices of the Canton Telephone Administration in Canton, and a typist without any technical skill whatever can proceed to type messages in Hongkong, which are received in Canton, and *vice versa*. The message is typed on to a strip at both ends and is cut up and pasted on to a form, if required, to make it up as a letter.

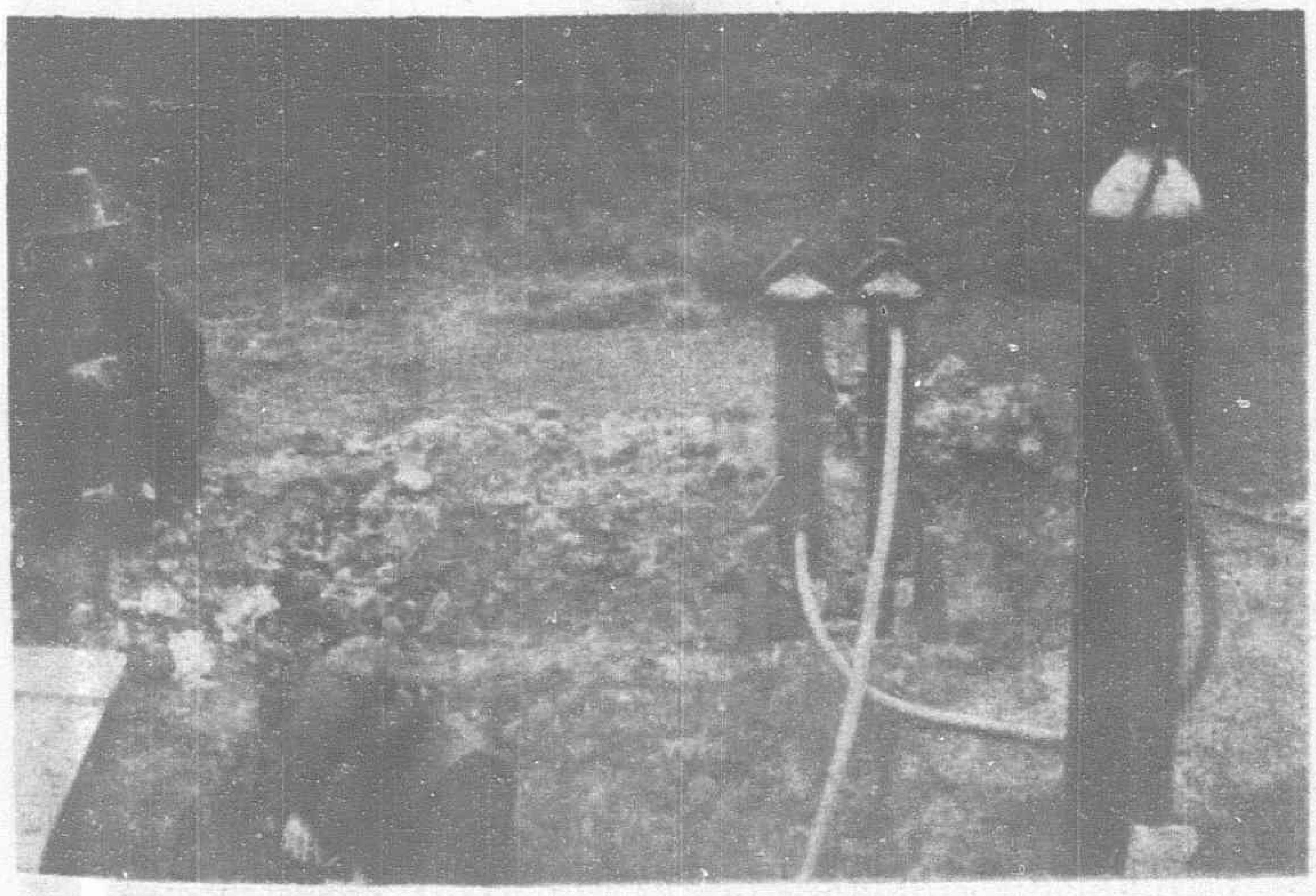
In a report published by the *Overland China Mail* the cost of the undertaking is placed at £120,000 and this journal gives interesting details of the manner in which the work was done, saying the operations began at the end of January, 1931, and were completed on August 4.

Mr. Burnett, of the International Telegraph and Telephone Company, was in charge of the work and had associated with him Mr. Graham, Mr. Barkwith and Mr. Westerhout, all of the Standard Telephone and Cables Company.

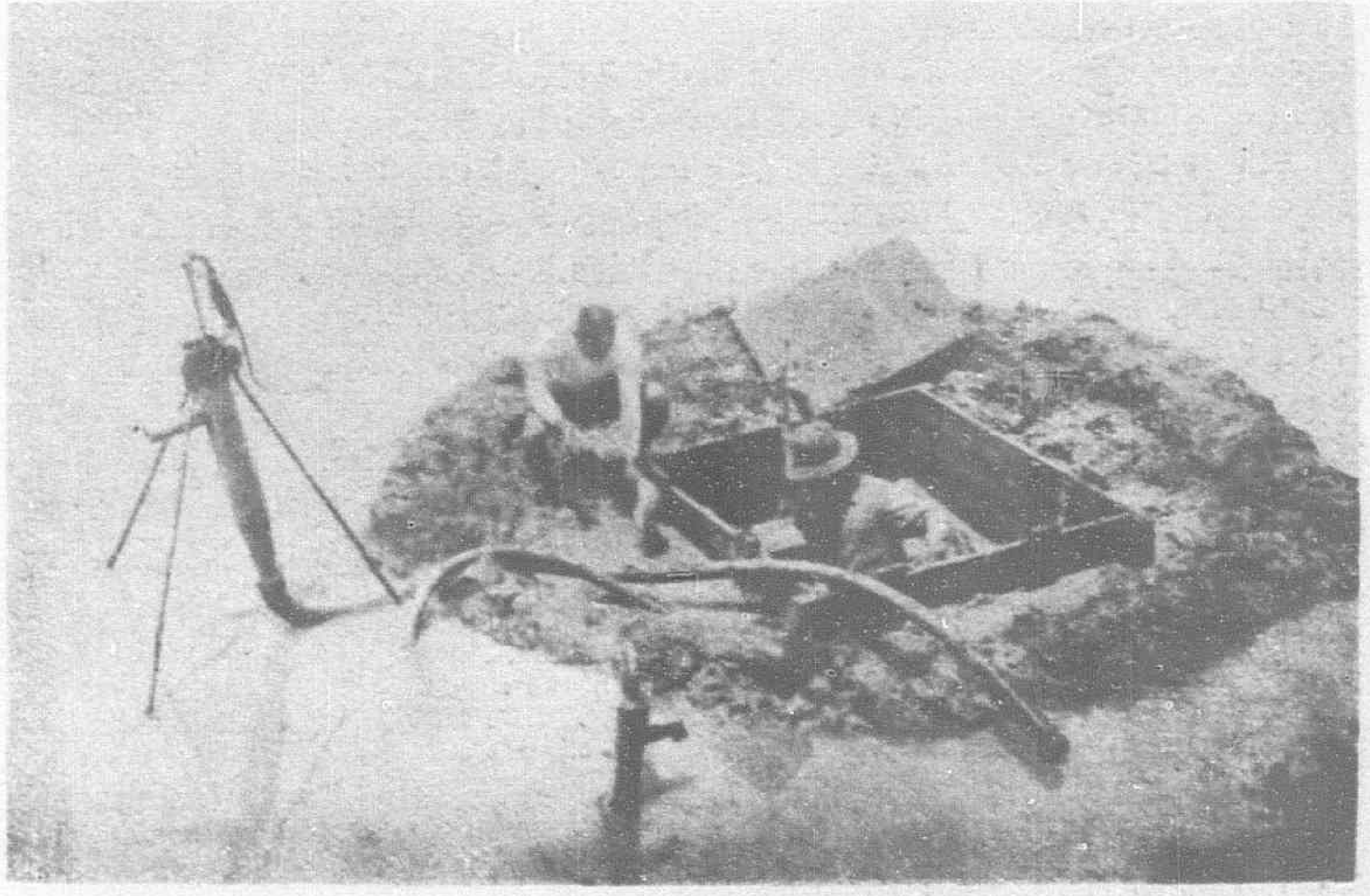
Under them they had a labor force of 150 Chinese. The laborers had to be trained before starting work. They had never seen or heard of a telephone cable before. But they were quick learners and, with the capable tuition they received, attained



Pump-Handle "Trolley-Mobile" Transport Setting out on Job complete with National Guard



Air Pressure Testing



After week of fine weather Banking for a Loading Joint made three feet below Flood Level a stage of very reasonable proficiency in two or three weeks. The training was continued with productive work.

Throughout the six months taken to lay the cable no trouble was experienced with the labor force. This is a tribute to the tact which must have been displayed by those in charge of operations.

The labor force was divided into four groups, each under the charge and control of one of the experts mentioned before. The camps were widely separated, being some 15 to 20 miles apart and engaged on different sections of the work.

Starting from Canton a mile of cable was laid per day. That represented 20 per cent of the completed job. Trenches had to be dug as they went along and there was, of course, more work after the cable was in the ground. Each section is 1⅛th miles in length and is made up of six lengths. Each of these lengths had to be tested for various electrical quantities and characteristics before it was joined up. These tests had to be made under all sorts of conditions. It is generally hard work and was made more difficult by inclement weather conditions.

As far as possible the cable has been carried along the bottom of railway embankments but circumstances did not always permit of this being done. Deviations had to be made to allow for the geographical conditions of the country through which the cable was carried. The cable has been carried over hills, through valleys and through rivers.

Three large rivers had to be negotiated. One of them was 1,000 yards wide. That is the river at Shek-lung. At these points locally engaged sampans were employed and the labor force augmented. The cable at river points is of a special type made to withstand possibility of damage from the punt poles of sampans. It is heavily armored steel wire and will withstand considerable illusage. It is very necessary that this should be so, because a fault at any of these points will dislocate the entire service.

Work was held up for some time by excessive floods in the vicinity of Shek-lung and Sheung-ping. At these places the cable was submerged in 15 to 30 feet of water. The water level in these places at the time was rising at the rate of four to five feet in 24 hours. The cable was later tested and found not to have been adversely affected by the flooding. But work in these sections had to be abandoned for some six weeks or so.

The foreign staff lived under canvas for a period of about four months. They had to carry along their own food supplies and get their water from either Canton or Hongkong. Only great difficulty in the matter of food supplies was experienced on one occasion, and that was due to the dislocation of traffic owing to an accident at Shating. The Europeans then had to come into Hongkong by trolley to obtain supplies.

The further the camps moved from Canton the more serious became the bandit question. To guard against these marauders each camp had to maintain an armed force of Nationalist Guard. There was only one real scare and that was at Ping Wu when it seemed there was some possibility of a raid. Bandits were known to be in the vicinity. But nothing happened.

The Chinese labor force did not seem to be greatly perturbed on that occasion. They appeared to have every confidence in the armed guard at the camps. They continued their work without interruption and fear.

For the most part it was very hot, and at nights there were plagues of flying beetles and insects, also mosquitoes.

Surprisingly little sickness was experienced by either foreign or Chinese staffs. They came right through with a clean bill of health. Also there were no casualties.

The boundary or border was passed about the middle of June, and thereafter the cable was carried for the greater part of the remainder of the way, along the Taipo Road.

The greatest height at which the cable has been laid is about 400 feet above sea level.

Buys Japanese Steel

According to the *Manila Bulletin*. Japanese steel is for the first time being seriously considered in connection with plans for the construction of some of Manila's modern office buildings. Mariano Cu Unjieng and Rafael Fernande, well-known Manila real estate owners, it is understood, are thinking of using Japanese structural steel in their proposed building on the corner of Escolta and Pinpin. If the plan goes through, this material will also be used in the proposed new theater to be erected alongside the building proper.

A big factor in favor of Japanese steel is that it is cheaper than any other kind of steel used in building construction, it is pointed out.

An attempt was made recently by S. Nagauye, Japanese contractor, to introduce Japanese steel in the construction of bridges in the Philippines. The Department of Commerce and Communications has approved the contract with Nagauye for the construction of the steel bridge over Abra River at Banaoang, Ilocos Sur. The contractor offered to use Japanese steel, but he has been unable to meet certain specifications required by the Bureau of Public Works. Instead, he will use American steel fabricated by the Atlantic Gulf.

The Banaoang Bridge when completed will be the longest bridge on the Manila north road outside of the Gilbert Bridge in Laoag. It will be about 160 meters long, having four steel spans supported by steel shell filled with concrete. The project will cost approximately 500,000 pesos and will take about a year and a half to finish.

The contractor has performed several big jobs for the Bureau of Public Works. His last big project was the irrigation canals for the Penaranda River irrigation system in Mueva Ecija, which irrigates an area of about 18,000 hectares.

Structural steel is coming into greater popularity with building contractors in Manila. The first building to use this material is the Filipinas Insurance Building on Plaza Moraga. The Lyric Theater and the Metropolitan Theater now under construction on the Botanical Gardens used structural steel for their frame-work.

The latest building to use structural steel is the new Bay View Hotel which is being erected on Dewey Boulevard and Alhambra by the Kneedler Realty Company. This is the first hotel in Manila to employ this material. The steel for this building was fabricated by the Atlantic Gulf and Pacific Company.

Structural steel costs more than steel used in reinforced concrete construction, but most contractors believe that for buildings over five stories this material is superior to the usual reinforced concrete.

Shipbuilding in Japan Active

The lower trend of shipbuilding costs is leading that industry to prosperity again after a long spell of inactivity coincident with the slackness of the shipping business. Orders for new boats are increasing in Japan.

It is a noticeable fact that almost all the vessels ordered recently are motorships. The shipping companies are all demanding motorships with a view to economizing in the navigation cost and also to increasing their credit with the shippers.

Some of the large-size ships now under construction or scheduled to be built are as follows :—

Osaka Shosen Kaisha : Two 9,700-ton ships, to be placed on the Japan-New York line, at the Mitsubishi's yard in Nagasaki. These will be completed before the fall of next year. A 6,300-ton ship is also at the Mitsubishi yard in Nagasaki. This is a cargo boat and is expected to be finished by March next year.

Ishihara Sangyo Kaisha : Orders will be placed for two 6,000-ton semi-cargo boats with the Mitsubishi yard in Nagasaki and the Harima Dockyard, respectively. These will be completed by the summer of next year.

Kokusai Kisen Kaisha : The Katsuragi Maru, 9,000 tons, 18 knots, now being built at the Uraga Dockyard, is expected to be launched September next. The Company is about to build two more boats of the same type and size as the *Katsuragi Maru*. No details in connection with the program have been made public yet.

Toyo Kisen Kaisha : To build a 9,000-ton freighter.

Nippon Yusen Kaisha : To build four 10,000-ton ships, or ships larger than 10,000-ton class, with a view to placing them on the New York line. The orders will be placed later when Mr. Kagami, President, returns from his trip abroad.

Mitsubishi Shipping Company : This company plans to covert all its boats into Diesel motorships gradually, hence orders are expected to be distributed among the builders before long.

Development of Telephone Communication in China

TELEPHONE communications was not introduced into China until 1900 when a Dane, Mr. Poulsen, established the so-called Bell Companies in Peping, Tientsin and Tanku, with not more than 300 subscribers. Through diplomatic negotiations, these three Companies were handed over to the Chinese Government in 1905. After this, local telephones in Shanghai, Hankow, Soochow, Nanking, etc., and toll telephone lines between Peping and Tientsin, Tientsin and Mukden, Shanghai and Nanking, Kirin and Changchun and Harbin, etc., were successively constructed. At the end of 1928, there were established more than twenty telephone offices with about 40,000 subscribers, and approximately 10,000 miles of main toll telephone lines in China. The following is a brief historical account of Government telephone service.

Local Telephone

When the telephones in Peping were first put under the control of the Chinese Government, the equipments were of the magneto system and had a capacity of 1,800 lines in total. In 1909, the common battery system was adapted and telephones were re-distributed between two offices, which have been called the South Office and the East Office. In 1917, there was installed the West Office ; and in 1924, the South Branch Office. The total capacity of these four Offices is about 20,000 lines. In addition, small branch offices were also established in Poating. Tunghsien, Nanyuan, Hsiyuan, Hsiangshan, and Tongshan, in direct connection with the city. Consequently the Peping Telephone Exchange, after its development for about twenty years, has come to be the largest among Government owned exchanges. But since the downfall of the old Peking Government, the number of subscribers have been gradually decreasing, probably owing to the fact that Peping has now ceased to be the political center and its commerce has also declined.

The Main Telephone Office in Tientsin is situated at Chaku. In 1913, the new office building was constructed and new equipments of the common battery system were installed. Afterwards, the South Office was founded in the British Concession, the East Office, in Italian Concession, and the North Office, in Hopeh (a district in Tientsin), the equipments being also of the common battery system. Since 1926, the equipments in the South Office, the East Office, and a part of the Main Office were all replaced by automatic ones, the total capacity of which is 9,000 lines. This is the first time the Government adapted the automatic telephone system for communication purposes. As to the North Office and the other part of the Main Office, they now still remain in their original condition, though there is the belief that the automatic telephone system will be introduced into them very soon. Besides the four Offices described above, there are also small branch offices of magneto equipments in distant towns as Tanku, Tangshan, etc. in connection with the city through toll lines.

The telephone exchanges in Hankow, Wuchang and Hanyang, were inaugurated in 1902 by local authorities. After 1907, their ownership has passed into the hands of the merchants. In 1914, however, the Wuhan telephones were taken over by the former Ministry of Communications. In the next year, great improvements were made, as new offices were built in Hankow and Wuchang, the equipments of which were of the common battery type. Unfortunately, the Wuchang Office was burnt in 1925, after which only a temporary magneto exchange of 400 lines was installed for maintaining the traffic. Telephones in Hanyang were originally in direct connection with Hankow through submarine cable. Afterwards, and independent office was founded, in which the system used was of the magneto type at first, and then was converted into common battery type of 280 lines in 1922.

Telephones in the Concessions in Shanghai were inaugurated by Shanghai Mutual Telephone Company operated under the ownership of the British merchants. Extensions of lines were frequently made beyond the boundaries of the concessions into the city. For the purpose of preserving its sovereignty, the Manchurian Government established the Shanghai Telephone Administration at Nanshih in which the equipments, being at first of the magneto type, were changed into the common battery type in 1922. Branch offices were also installed in Chapei, Kiangwan, Wusung, and Nanhsiang. In 1925, a contract was made between the Telephone Administration and the Mutual Telephone Company to the effect that the telephones of both concerns may be interconnected. At the same time the Shanghai-Nanking Toll Line was completed. So telephones in Shanghai are rapidly developing. At present, the main and the branch offices have a total capacity of more than 3,000 lines.

The telephone exchanges in Nanking and Soochow were established by the Ministry of Agriculture and Commerce of the Manchuria Government, and taken over by the Provincial Government at the beginning of the Republic. Since 1914, they passed into the control of the former Ministry of Communications. New office buildings were construted in 1919 and common battery equipments were installed in 1922. The Soochow Exchange has a capacity of 2,000 lines and the Nanking Exchange, together with branch offices at Shiakuan, Pukow and Puchun, has a total capacity of 3,100 lines. Since Nanking became the capital of the Nationilast Government, the subscribers have been enormously increasing, and consequently the original equipments have proved inadequate to meet with the demands. At the end of 1928, a contract was made between the Ministry of Communications and the American Automatic Electric Co. For the purchasing of 5,000 lines of automatic equipments. It is predicted that the new installation will be completed in the autumn of this year.

In addition to those telephone administrations already mentioned, there are offices in Chingkiang, Yangchow, Wuhu, Pengpu-Kiukiang, Shiashih, Chefoo, Taiyuan, Kirin, Changchun, Taonan, etc. As these latter offices are operated on a comparatively small scale, no detailed descriptions are necessary.

Toll Telephone

The Peping-Tientsin Toll Lines were also built by Mr. Poulsen, the Dane, and were taken over together with the local telephones in Peping and Tientsin by the Manchurian Government. At first, there were only two circuits, but, through successive extensions, there are altogether eleven circuits at present.

The Tientsin-Mukden Toll Lines were built on telegraph poles in three stages from 1924 to 1927. There are two circuits of 200 lbs. copper and one circuit of 400 lbs. copper wire.

The Tsinan-Tsingtao Toll Lines were built by the Japanese during their occupation of Tsingtao, and were put under the control of the former Ministry of Communications in 1923 when that port was surrendered to China. Through repeated negotiations with the Tsingtao and Tsinan Telephone Companies, an agreement was made in 1924 for the interconnection of the toll and local lines.

The Kirin-Changchun-Harbin Toll Lines were put with two pairs of wires on telegraph poles and with two others on telephone poles newly planted.

The Shanghai-Nanking Toll Lines were put on telegraph poles in 1925. At first two pairs of wires were laid between Shanghai and Wusih and one of them was extended to Nanking in 1927. At the beginning of 1929, one more circuit was added between Shanghai and Nanking and another between Wusih and Nanking.

The above stated toll lines are all main lines of copper wire. Besides, many toll lines have been built in Chekiang, Kiangsu, Shansi, the Eastern Provinces, etc., having a total length of about 20,000 li. Most of them are built with iron wire on telegraph poles and need re-construction and further improvement.

The general conditions of the Ministry's telephones may be seen from the following table :—

LOCAL TELEPHONES.

Place	*Type of Equipment*	*Present Capacity in Lines*
Peping	Common battery ...	19,540
	Magneto	547
Tientsin	Automatic	9,000
	Common battery ...	3,600
	Magneto	
Paoting	Magneto	500
Kirin	Magneto	600
Changchun	Magneto	400
Taonan	Magneto	200
Taiyuan	Magneto	500
Chefoo	Magneto	580
Chengchow	Magneto	300
Shanghai	Common battery ...	2,000
	Magneto	980
Soochow	Common battery ...	2,000
Chingkiang	Magneto	500
Yangchow	Magneto	400
Nanking	Common battery ...	2,800
	Magneto	300
Wuhu	Magneto	660
Pengpu	Magneto	300
Kiukiang	Magneto	150
Hankow	Common battery ...	4,300
	Magneto	120
Wuchang	Magneto	400
Hanyang	Common battery ...	280
Shiashih	Magneto	100
Kingchow	Magneto	26
Total	Automatic	9,000
	Common battery ...	34,520
	Magneto	7,563

Place	*Distance in li*	*Kind of Wire*	*Number of Circuits*
Peping-Tientsin	240	200 lbs. copper wire ...	1
		400 lbs. copper wire ...	6
		Partly copper and partly iron	4
Tientsin-Mukden	1,310	200 lbs. copper wire ...	2
		400 lbs. copper wire ...	1
Kirin-Changchun-Harbin	690	200 lbs. copper wire ...	4
Tsinan-Tsingtao	820	200 lbs. copper wire ...	2
Shanghai-Nanking	670	200 lbs. copper wire (between Nanking and Wusih) ...	1
		100 lbs. copper wire (between Wusih and Shanghai)	1

Although the telephone business, generally speaking, is owned and operated exclusively by the Government, yet, owing to financial limitations, it has not been fully developed. Many telephone companies are now owned by merchants or the local governments. Most of those companies owned by the local governments have not yet been registered with the Ministry of Communications and hence it is almost impossible to make a sketch of them. Nevertheless, among telephone companies that are owned by merchants, 36 have already petitioned to this Ministry for registration. The following table tells their existing conditions :—

Place	*Type of Equipment*	*Present Capacity in Lines*
Changshu	Magneto	450
Haimen	Magneto	210
Taitsang	Magneto	400
Kunshan	Magneto	200
Wusih	Common bettery ...	1,000
Liyang	Magneto	100
Taihing	Magneto	50
Changchow	Common battery ...	800
Kaoyu	Magneto	150
Hsuchow	Magneto	100
Taihsien	Magneto	200
Nantung	Magneto	570
Shengtseh	Magneto	150
Hangchow	Magneto	2,540
Nanzin	Magneto	150
Wuhing (city)	Magneto	500
Wuhing (Shwanglingchen)	Magento	50
Kashing	Magneto	350
Ningpo	Magneto	1,300
Tinghai	Magneto	200
Shashih	Magneto	240
Kashan	Magneto	120
Wenchow	Magneto	300
Siaoshan	Magneto	
Tsungming	Magneto	100
Haining	Magneto	118
Haining (Yuanhwa)	Magneto	50
Kwangtah	Magneto	60
Ichang	Magneto	100
Changteh	Magneto	200
Tsanghsien	Magneto	100
Kalgan	Magneto	800
Fengchen	Magneto	100
Kweisui	Magneto	400
Paotow	Magneto	200
Haining (Hsiachuan)	Magneto	18
Total	Common battery ...	1,800
	Magneto	10,658

Depression Hits Japan's Power Industries

The general depression since the fall of 1929 is also adversely reflected upon the electric power business in Japan. The survey made on the basis of the reports of the eight power companies, in addition to the five largest concerns, covering the results for the first half of this year, reveals the wane of the power business.

The first half of this year witnessed a depreciation of profit heavier than in the latter half of last year, the amount for the 13 companies, inclusive of the five biggest companies, being Y.57,594,000 against Y.61,802,000, for the preceding period. Further details show that the profit of the five biggest concerns (the Tokyo Light, the Toho, the Nippon, the Daido and the Ujigawa Power Companies) was Y.37,861,000 against Y.41,576,000. The profit of the eight smaller companies (the Kyoto Light, the Godo Power, the Kyushu Power, the Hokkaido Light, the Toshin Power, the Kinugawa Power, the Sanyo Chuo Power, and the Chugoku Godo Power Companies) was Y.19,733,000 against Y.20,226,000.

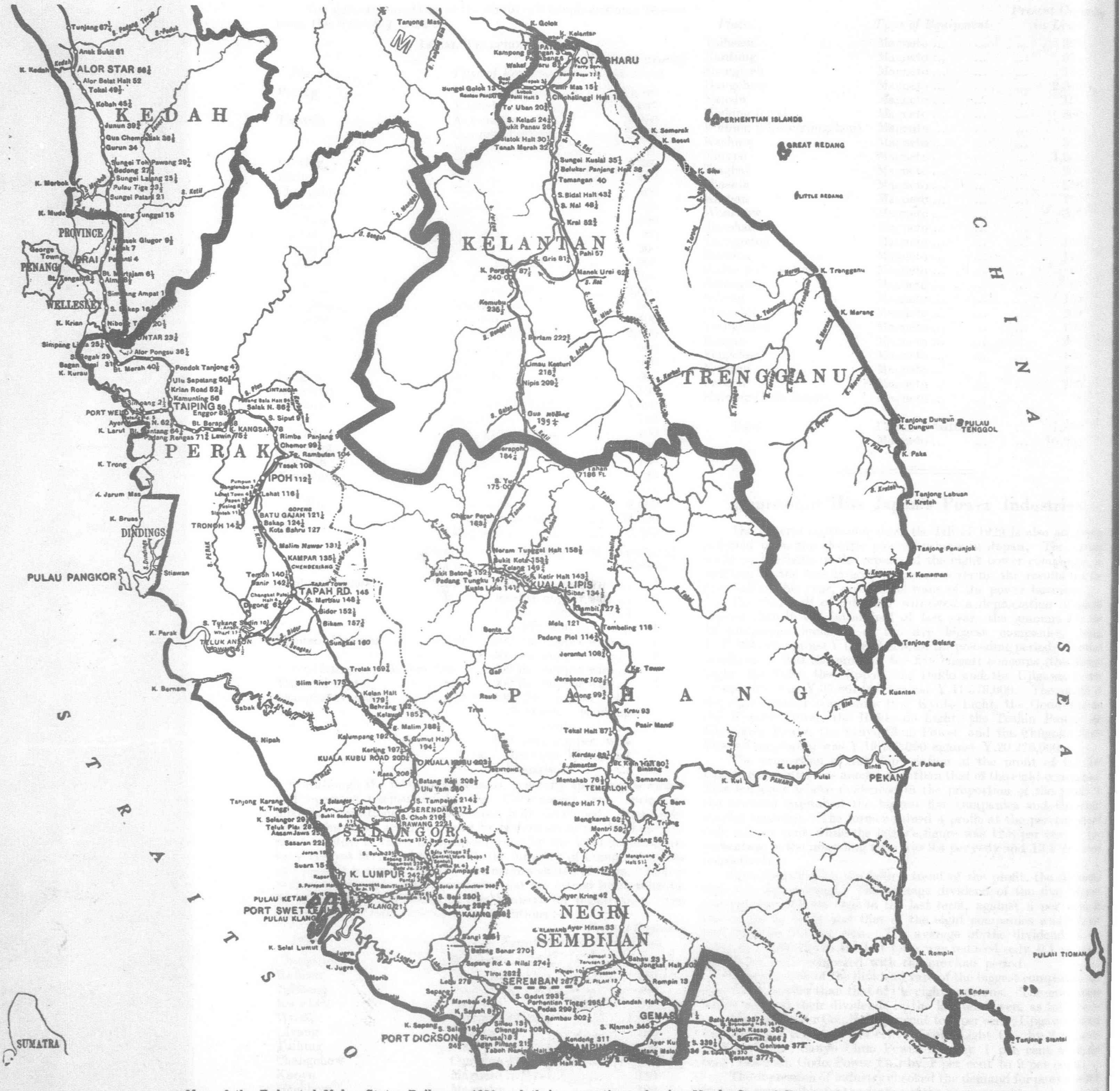
The proportion of the depreciation of the profit of the five biggest companies was much larger than that of the eight companies. This tendency is also evidenced in the proportion of the profit to the invested capital of the biggest five companies and the eight smaller concerns. The former gained a profit at the percentage of only 8.8 per cent while the latter's figure was 12.8 per cent. The percentage in the preceding term was 9.4 per cent and 13.1 per cent respectively.

Coincidently with the falling trend of the profit, the dividend rate was also reduced. The average dividend of the five biggest concerns was 5.9 per cent in the last term, against 6 per cent in the preceding term, and that of the eight companies was 8.8 per cent against 9.2 per cent. The average of the dividend of the total 13 companies in the last term was reduced only 0.1 per cent to 6.7 per cent, compared with the previous period.

The reduction of the dividend rate of the biggest companies was somewhat smaller than that of the eight concerns. The companies which reduced their dividends in the last term were as follows :—

Nippon Power Co., by 1 per cent to 7 per cent; Ujigawa Power Co., by 2 per cent to 8 per cent; Kyoto Light Co., by 2 per cent to 8 per cent; Sanyo Chuo Power Co., by 1 per cent to 9 per cent; Chugoku Godo Power Co., by 1 per cent to 9 per cent.

The depression of industry checked the demand for power, which fact was responsible for the decline of the power companies' business.



Map of the Federated Malay States Railways, 1930 and their connections showing Newly Opened East Coast Connection through Kelantan

Malaya's Midland Railway is Opened

Project Launched in 1904 and Delayed Through Years of Great War is at Length Brought to Completion

EARLY in September a formal ceremony marked the opening of the last section of the East Coast Railway of the railway system of the Federated Malay States. This took place on a point on the line between Kuala Pergau and Kuala Gris Stations, and was attended by Sir Cecil Clementi, High-Commissioner, his Highness the Sultan of Kelantan, leading railway officials and a distinguished gathering.

Opening of this new railway section links the system with the railways of Siam and provides through railway travel through the Federated Malay States, the Unfederated Malay States, giving travelers to Siam from the south an overland route instead of traveling by way of Bukit Mertajam. An extremely interesting account reviewing the history of the work, as reported by the *Singapore Free Press*, was given in an address at the opening ceremony by Mr. J. Strachan, General Manager and Chief Engineer. He said:

In 1904 a decision was made to construct a railway from Tumpat on the East Coast of Kelantan, through the states of Kelantan, Pahang and Negri Sembilan, and join up to the existing railway at Gemas, a distance of about 328 miles. Location engineers started survey work at the end of that year, *viz ;* 1904. In 1908 the construction was started from Gemas northwards and in April 1912, construction was started from Tumpat southwards.

The railway from Gemas to the north progressed as follows :—1910 reached the boundary between Negri Sembilan and Pahang ; 1912 reached Kuala Krau ; 1917 reached Kuala Lipis ; 1921 reached Padang Tungku ; 1923 reached Chigar Perah ; December 1927 reached Merapoh and the Pahang—Kelantan Boundary ; July 1930 reached Gua Musang.

From Tumpat southwards the completion dates are as follows:—1914 to Tanah Merah ; 1924 to Krai ; 1927 to Manek Urai ; 1930 to Kuala Gris ; 1931 Gua Musang.

While construction on the East Coast railway was proceeding the Siamese Government was constructing a railway from the Perlis Siamese border *viz* Haad Yai through Patani to the Kelantan—Siamese boundary at Sungai Golok. To connect with this railway the F.M.S. Railways constructed a branch line from Pasir Mas to Sungei Golok. This branch is known as the Sungei Golok Line and connects the East Coast Railway with the Siamese system. The work was commenced in February 1917 and was completed to Rantau Panjang (the boundary) and opened for local traffic in September 1920. The connecting link of 15 chains between the boundary and Sungei Golok joint station was opened for traffic in November 1921. The completion of the East Coast line provides an alternative route from Malaya to Siam.

23½ Miles per Year

The dates mentioned show that the 328 miles of railway, excluding the Sungei Golok Branch, took 23 years to construct, the rate of progress being 14¼ miles per annum, and at first thought it would appear that progress has been slow, but I would ask that consideration be given to the fact that construction was seriously delayed by :—

First—Owing to the Great War, work practically ceased for four years ; Second—During the slump in 1921 and for two years after work between Krai and Chigar Perah was deferred three years ; Third—At the end of 1926 and early 1927 a devastating flood took place, camps and buildings were washed away, many bridges and structures were irreparably damaged, heavy earthworks were destroyed. This flood damage cost millions of dollars to repair and delayed the completion of the work two years.

These delays total to nine years and reduce the period of construction to 14 years and give the average rate of progress as 23½ miles per year.

To-day witnesses the opening of the last link of the railway, namely 46¼ miles between Gua Musang and Kuala Gris, all in Kelantan.

It may be of interest to hear that in the construction of the Kelantan section only, (*viz :* between the Pahang—Kelantan Boundary and Tumpat) a distance of about 140¼ miles, there are in the permanent works : (a) Earthwork 11,200,000 cubic yards ; (b) Culverts 400 No. totalling in length five miles ; (c) Bridges 178 No. totalling in length 3¾ miles ; (d) Steel girders 16,150 tons ; (e) Tunnels eight No. totalling 1½ miles ; (f) Length of railway and sidings 150½ miles ; (g) Steel rails 14,275 tons ; (h) Stone ballast 450,000 cubic yards ; (i) Sleepers 320,000 No.; (j) Station buildings and quarters 692 units.

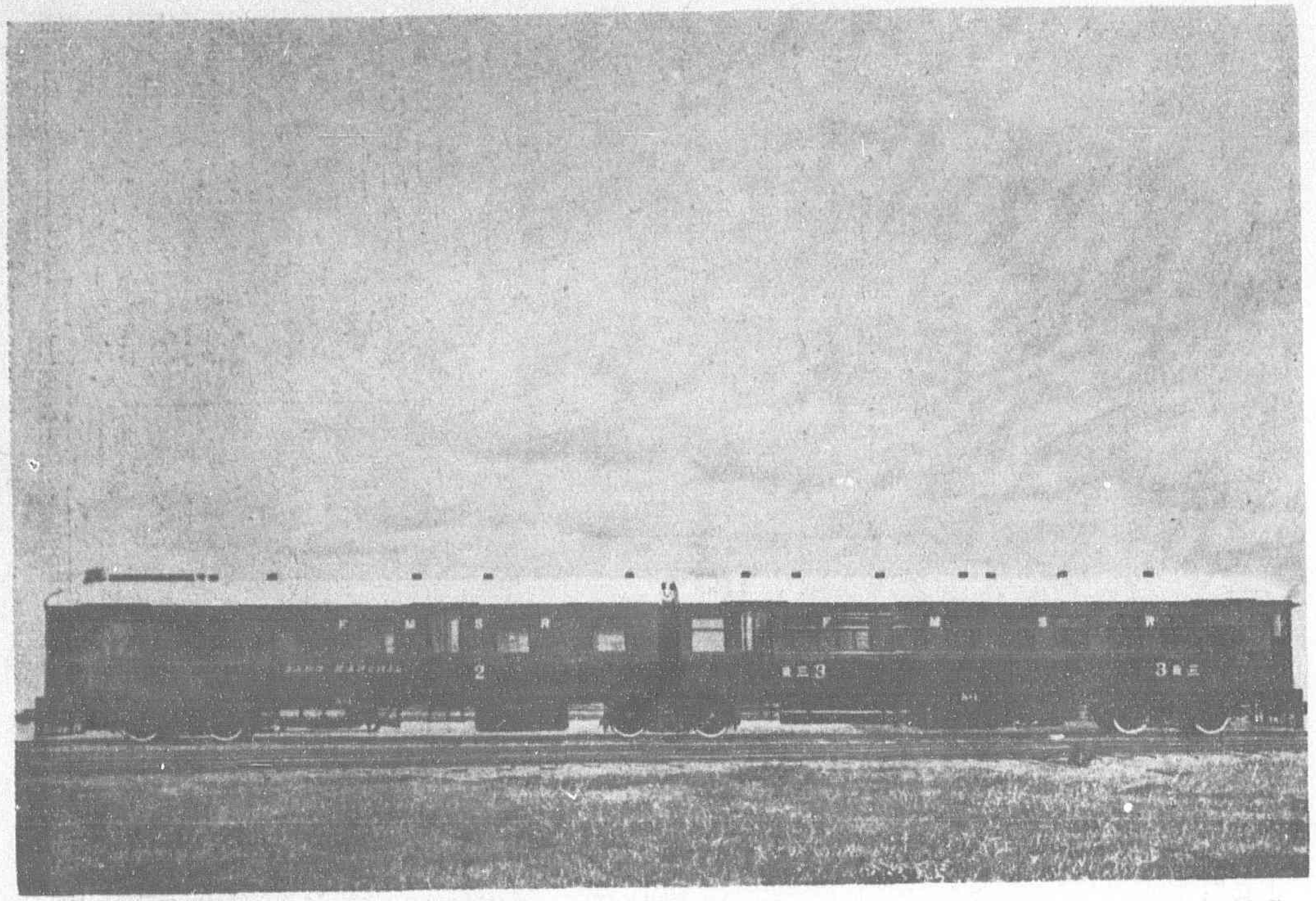
Express's Time-Table

A service of trains both passenger and goods has been brought into force as follows :—

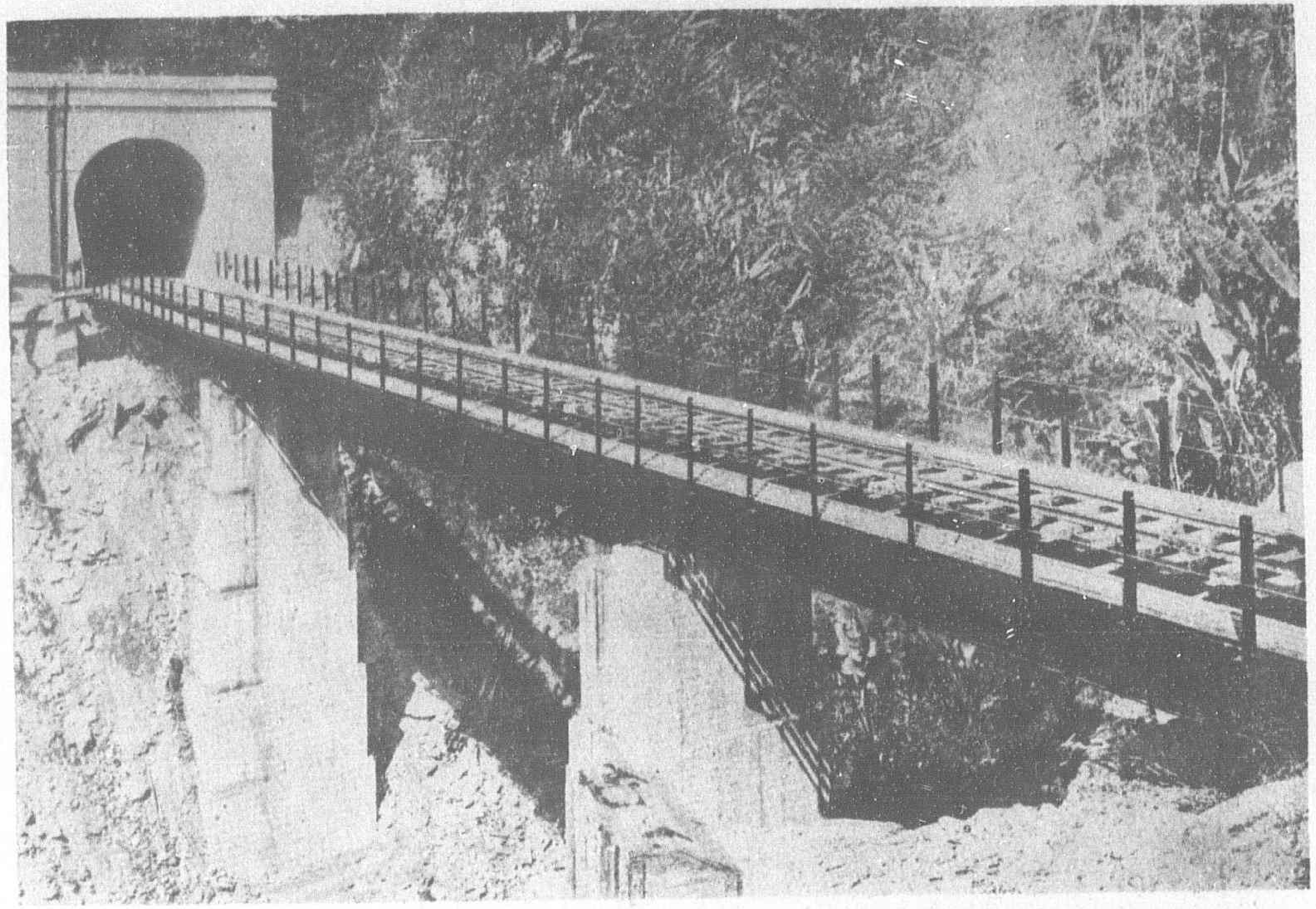
An Express passenger train will leave Tumpat every Thursday morning with through carriages, with day and night accommodation, and will arrive at Singapore on Friday morning, the through journey occupying 20½ hours. Through carriages on the return journey will leave Singapore at 8.30 p.m. on Sunday evening and arrive at Tumpat on Monday afternoon. In addition there will be three mixed (passenger and goods) trains each way weekly. The time occupied by this train from Kuala Lipis to Krai will be seven hours and to Tumpat 10¾ hours. This time-table has been selected after discussion with various officials and planters and after a working trial has been made re-adjustments may be necessary to suit the convenience of passengers and consignees of goods. It must be borne in mind that a development railway such as this cannot be expected to pay its way for some years but the railway administration are giving you a good service and asks for your co-operation and support in return. The more traffic that is offered, the better service.

The construction staff had a hard task, the work has been exceedingly heavy and of a difficult nature ; transport difficulties, sickness, frequent tropical rains and floods have had to be overcome. All ranks and races have shown a fine spirit ; some have died at their posts, many rest in France, others are scattered over various parts of the world. We heartily congratulate Mr. W. J. Haskins, the Engineer for Construction, on the very satisfactory completion of the railway, but all of us remember

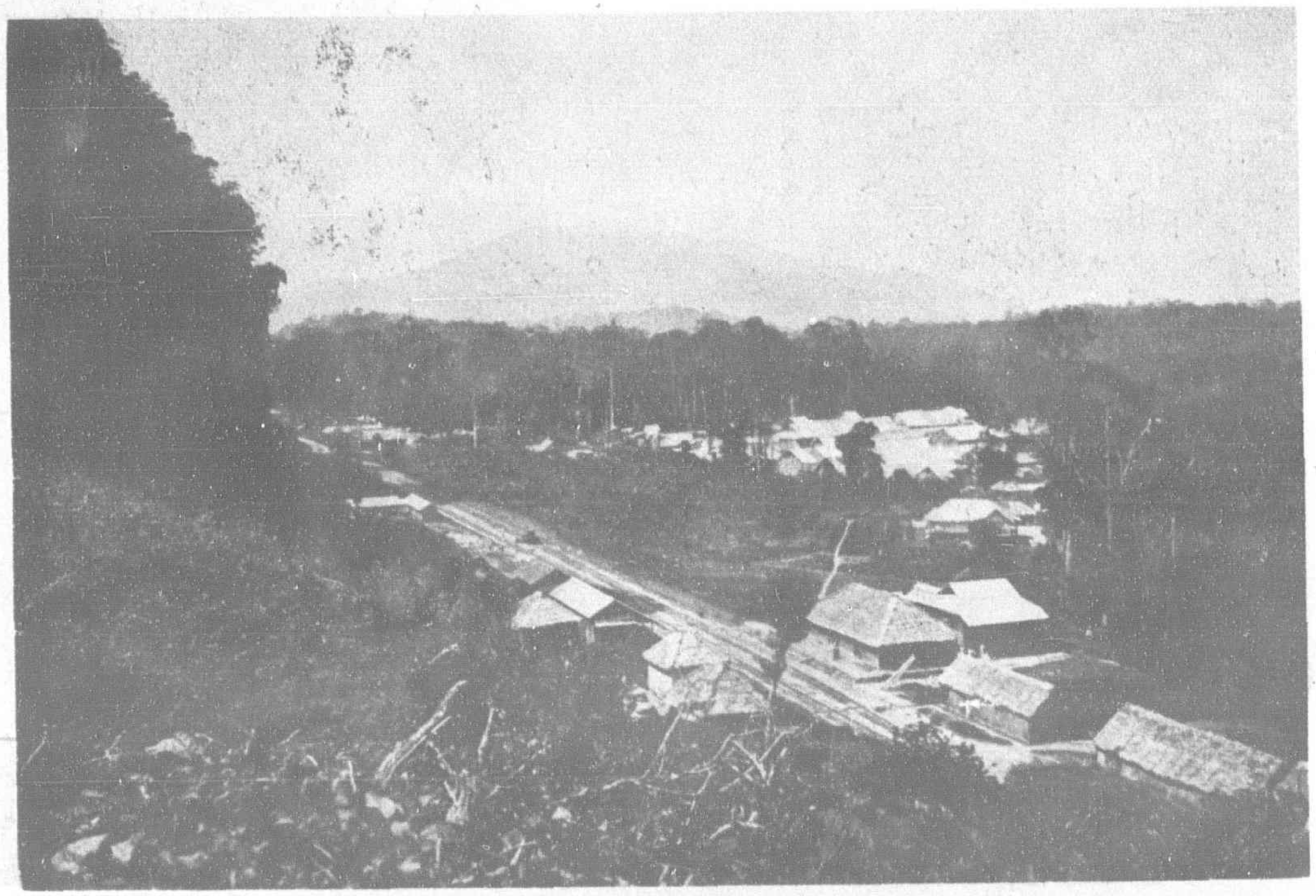
Singapore Night Mail Train of the F.M.S. Railways on Johore Causeway



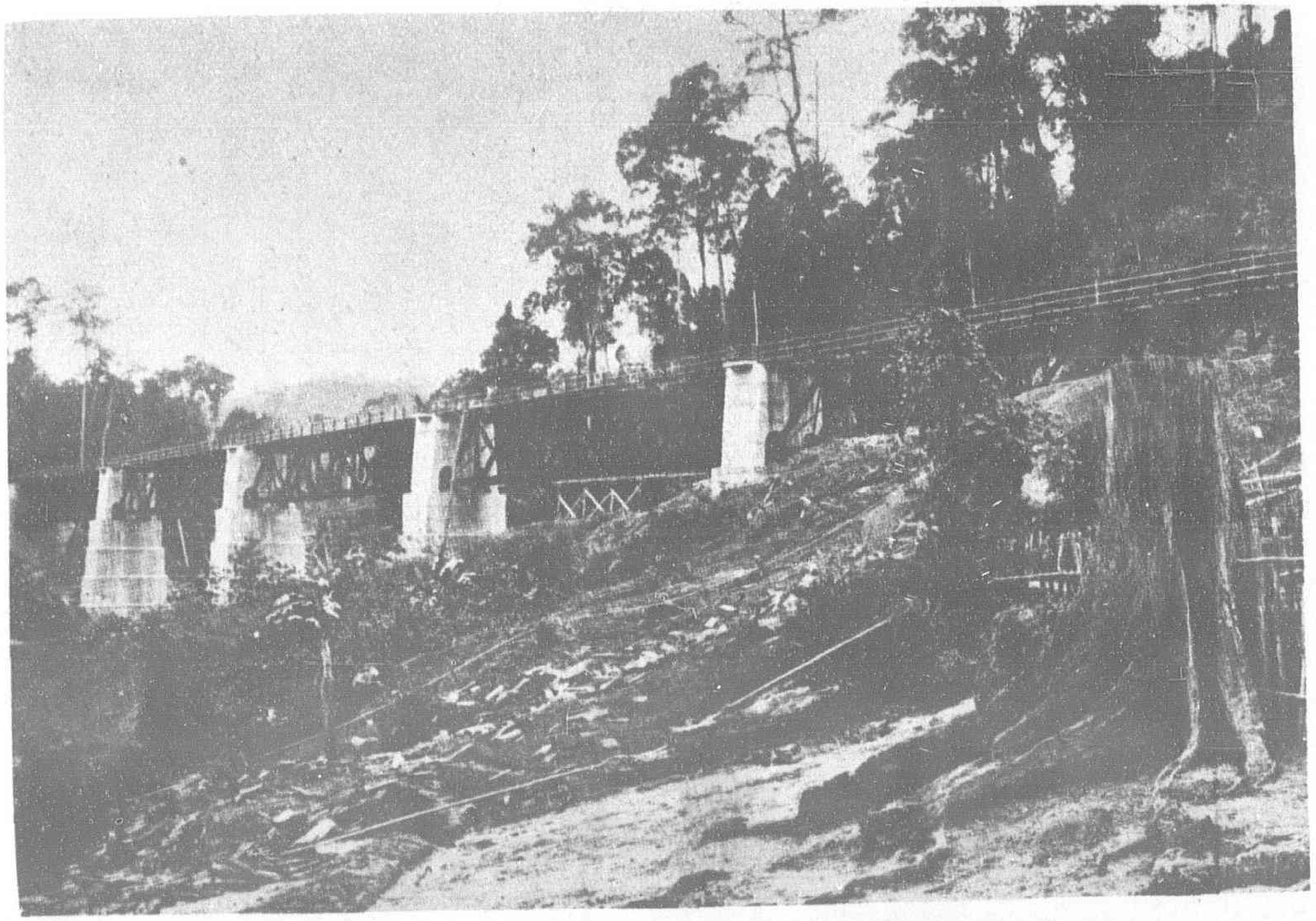
Rail Motor Articulated Coach “Sang Kanchil”, Type being brought into use on F.M.S. Railways



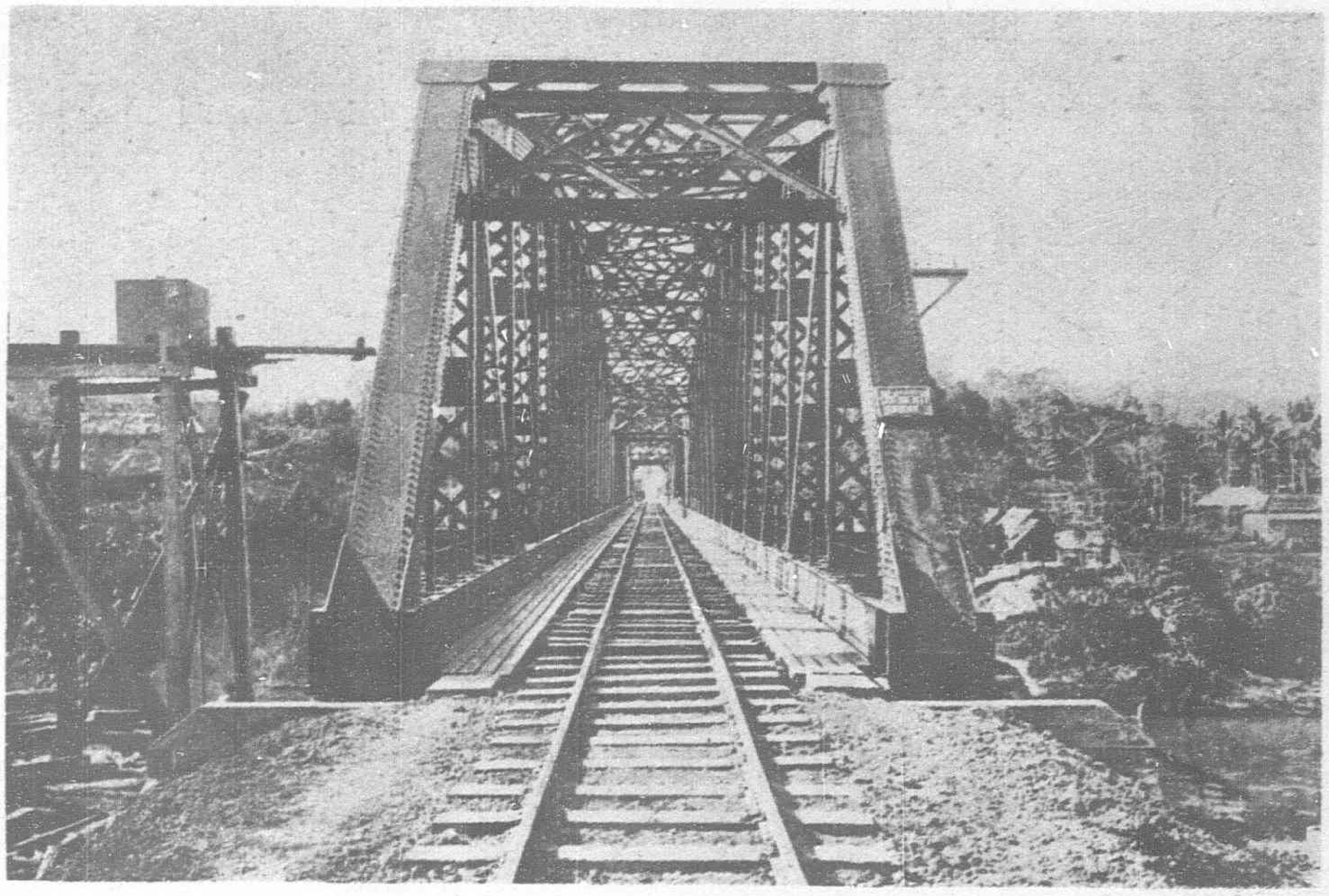
North Portal of Tunnel 11 with three of 60 feet Deck Girder Bridge at Mile 243½, East Coast Railway



East Coast Railway Kelantan—View from Gua Musang (199¼ mile) Looking South



East Coast Railway Kelantan—Bridge at Mile 258½ from Gemas



North Portal Clementi Bridge, two spans of 250 feet and one of 100 feet over Sungei Nenggiri at Mile 222 on the East Coast Railway

the absent ones who have helped in the construction.

Governor and Sultan's Interest

To the Government of Kelantan and its officers I offer on behalf of the railway my thanks for the cordial co-operation, advice and assistance they have willingly given at all times. With great respect I tender to Your Highness may sincere thanks for the great interest you have always taken in the work of construction and the welfare of those engaged in it; our difficulties would have been much greater had we not been favored by such consideration. Your subjects rendered timely and valuable assistance in the restoration of the Sungei Golok Line which was washed away in the 1926-1927 flood; and for many years have served with great ability in the pioneer work of locations and surveys.

I would now respectfully ask Your Excellency and Your Highness to make the last fastening on the railway, by each driving a spike to secure the steel rail to the wooden sleeper, and afterwards to declare the railway to be open.

H.E. and the Flood

Jointly opening the line H.E. the Governor said :—

This day witnesses the completion of a very fine engineering achievement, and I heartily congratulate Mr. Strachan, the General Manager of Railways, and his staff on the work which they have accomplished. Not only is the country through which the Kelantan railway has been built of a very broken nature, involving the construction of an unusually large number of major bridges, *via* ducts and tunnels, but there have been great difficulties in regard to the transport of materials and the staff has been much hampered by sickness and by deluges of tropical rain. I need only remind you how the great flood of 1926-27 destroyed in a few days the work of many years. A scene of desolation was left after the floods subsided. The supervising staff, the clerks and thousands of coolies were homeless and foodless, and the task of reorganization appeared to be well-nigh hopeless. It was amid this disaster that Mr. Strachan arrived in Malaya and assumed duty as General Manager of the Railways in January, 1927. Under his inspiration, the construction engineers and their staff faced their troubles and trials with splendid spirit and proceeded to make order out of chaos. Many of them lived for months in temporary shacks and on rafts, working sixteen to eighteen hours a day, week in and week out. They were unable to obtain fresh food and their health suffered in consequence. The railway department was then under-staffed; but no complaint was made, and the engineers worked cheerfully to make good the immense damage. At that time a hundred miles of railway still had to be completed, and the lesson taught by the flood was that the line must be diverted. A new alignment was made under Mr. Strachan's supervision and is, above any possible flood-level. The successful completion of the work is due to the determination, loyalty and devotion to duty of the whole of the construction staff.

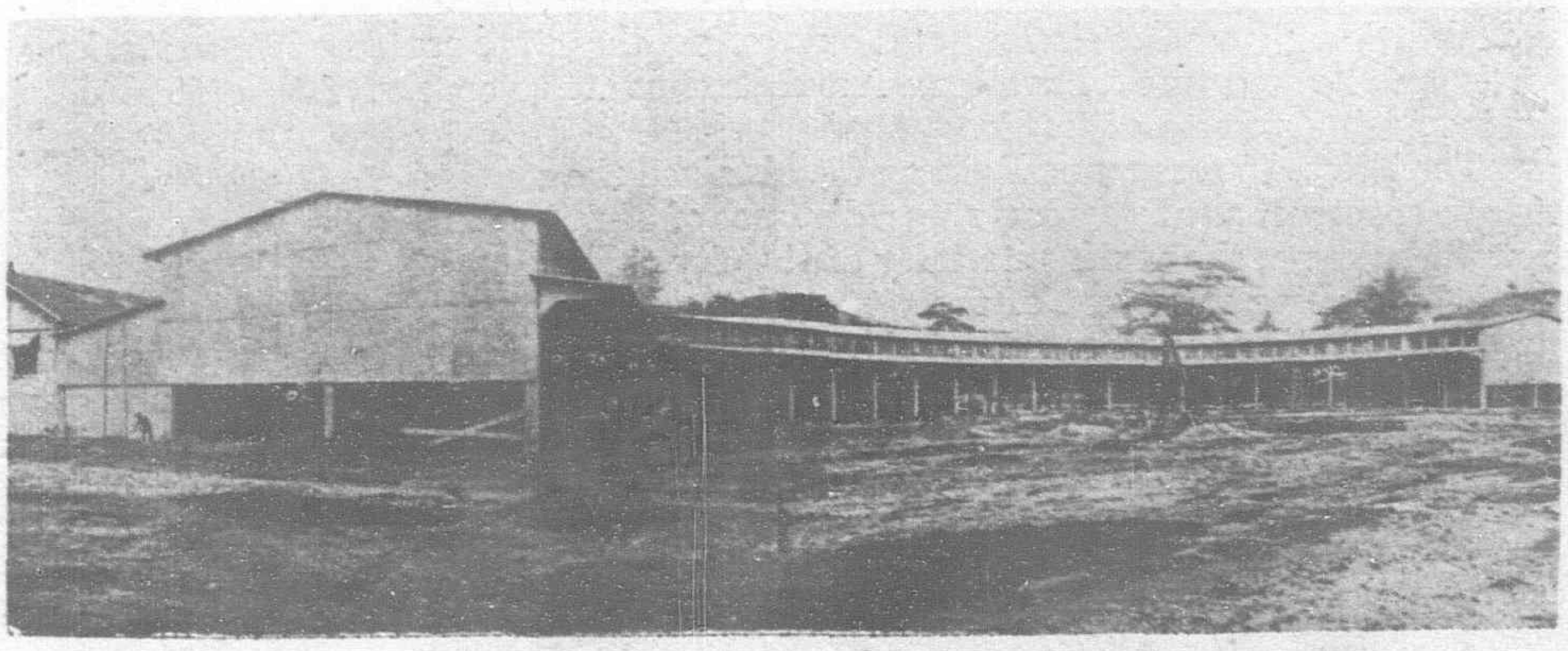
"Immense Benefit" to Kelantan

This line is opened at a time of world-wide trade depression; but, even under such circumstances, there can be little doubt that Kelantan will derive immense benefit from its completion, for the State will no longer be isolated and accessible only over seas, which at certain seasons of the year are very stormy, or by rivers, in which numerous cataracts render navigation difficult and dangerous. It is now linked forever closely by a permanent way southward to the neighboring State of Pahang, and beyond that to Negri Sembilan, Johore and Singapore, while to the northward it is joined up with Siam through the State of Patani, and at Haad Yai Junction this East Coast line connects with the West Coast line from Selangor, Perak, Kedah and Perlis, and after the junction continues to Bangkok. Already there are indications that the means of access to Kelantan, afforded by the railway, is being recognized as a valuable factor in the development of the State. Many thousands of acres, adjacent to the new line, have been taken up, and numerous inquiries are being received concerning the potentialities of Kelantan in respect of timber, Jelutong, gold and tin. This development, which has already begun at a time of great adversity will continue with increasing rapidity as trade and prosperity revive. The completion of the railway which now stands open for traffic, cannot fail to encourage new enterprises, for the progress of any country is largely dependent upon its transportation system. To-day the main trunk-line through Kelantan has been completed, and from it will in due course branch out minor ramifications in the form of feeder roads, designed not as competitors with the railway, but each co-ordinated to the other in the best interests of the whole State.

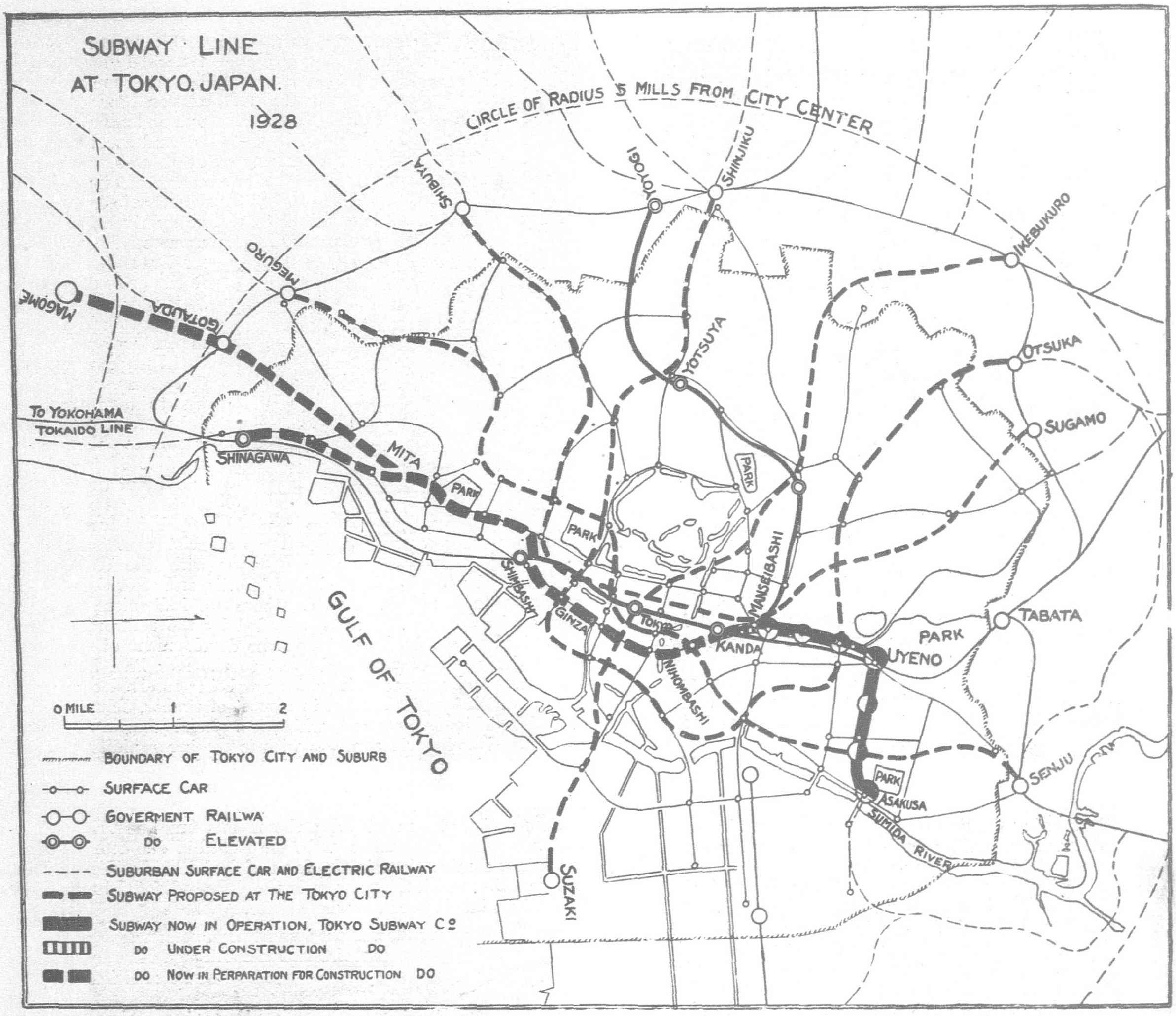
Soviet-Japanese Relations

At a luncheon given in Osaka on June 3, at which were present many prominent Japanese businessmen and bankers, Mr. Troyanovsky, the Soviet Ambassador to Japan, outlined the plan of economic development of the Asiatic part of the Soviet Union.

The U.S.S.R. said Mr. Troyanovsky, is ready to place orders to the extent of 50 million roubles in Japan. The Soviet Ambassador indicated that restrictions of any nature on Soviet exports would have an unfavorable effect on Japanese exports to the Soviet Union.



Locomotive Round House under Construction at Kuala Lumpur



Tokyo's Subway being Extended

Newly Completed Section between Manseibashi and Kanda Officially being Opened on December 1

TOKYO, which has a population (including suburban districts) of 5,000,000, lays claim to rank as one of the largest cities in the world.

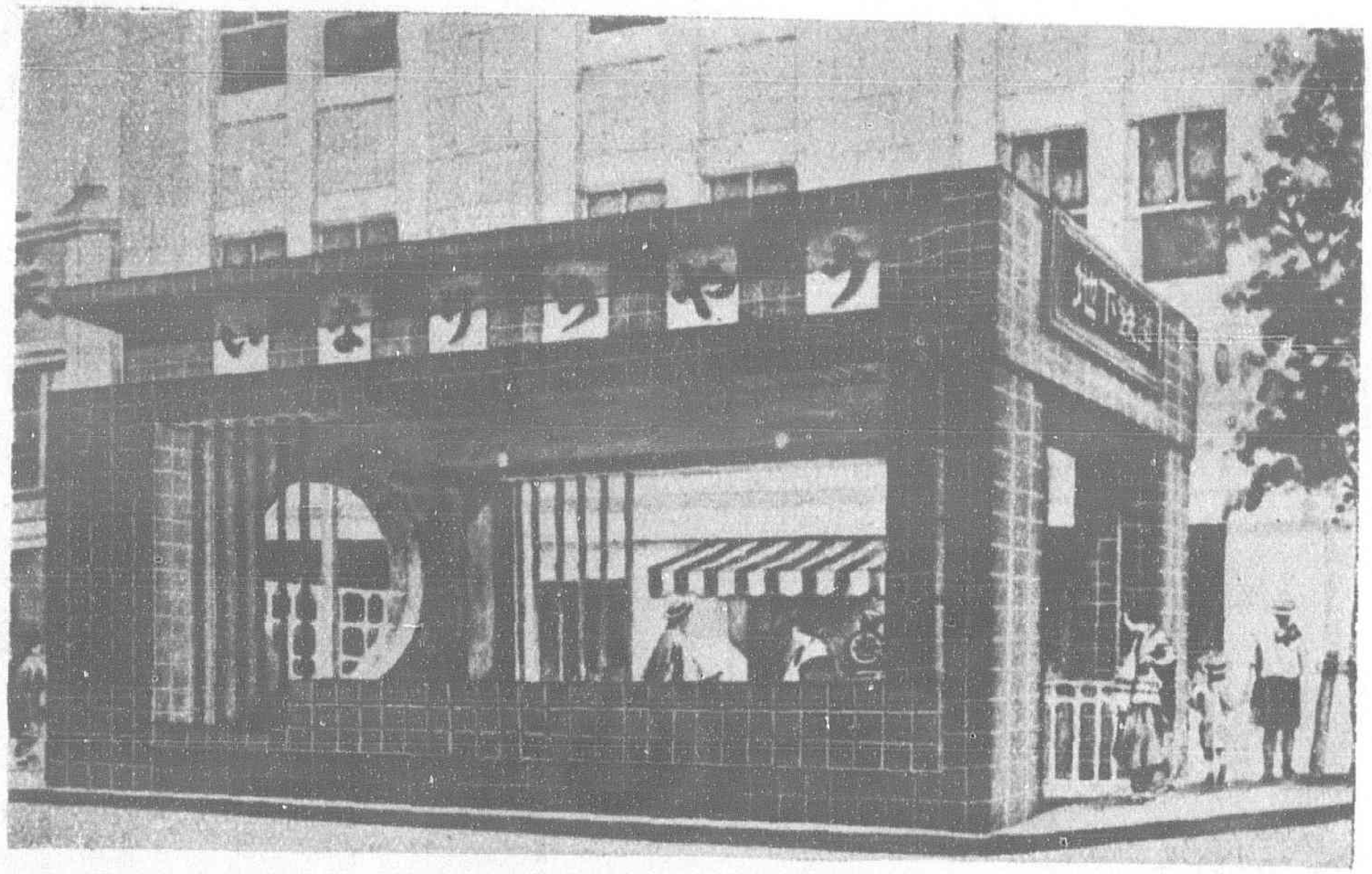
Transit facilities afforded by omnibuses, motor-cars and electric rail cars encircling and traversing the city, running partly on elevated track, have been found inadequate to cope with the increasing volume of traffic.

The Tokyo Underground Railway Co. obtained the concession in 1920 to construct a subway covering a distance of 8½ miles extending from Shinagawa, the south extremity of the city, to Asakusa in the north, tunnelling the heart of the city and touching the principal streets connecting the Government elevated railway stations. Subsequently a concession for a branch line from Mita, in the south on the Company's authorized line through Gotanda to Magome in the suburbs, a distance of 4½ miles, was secured. At Magome car shed and repair shops are to be constructed.

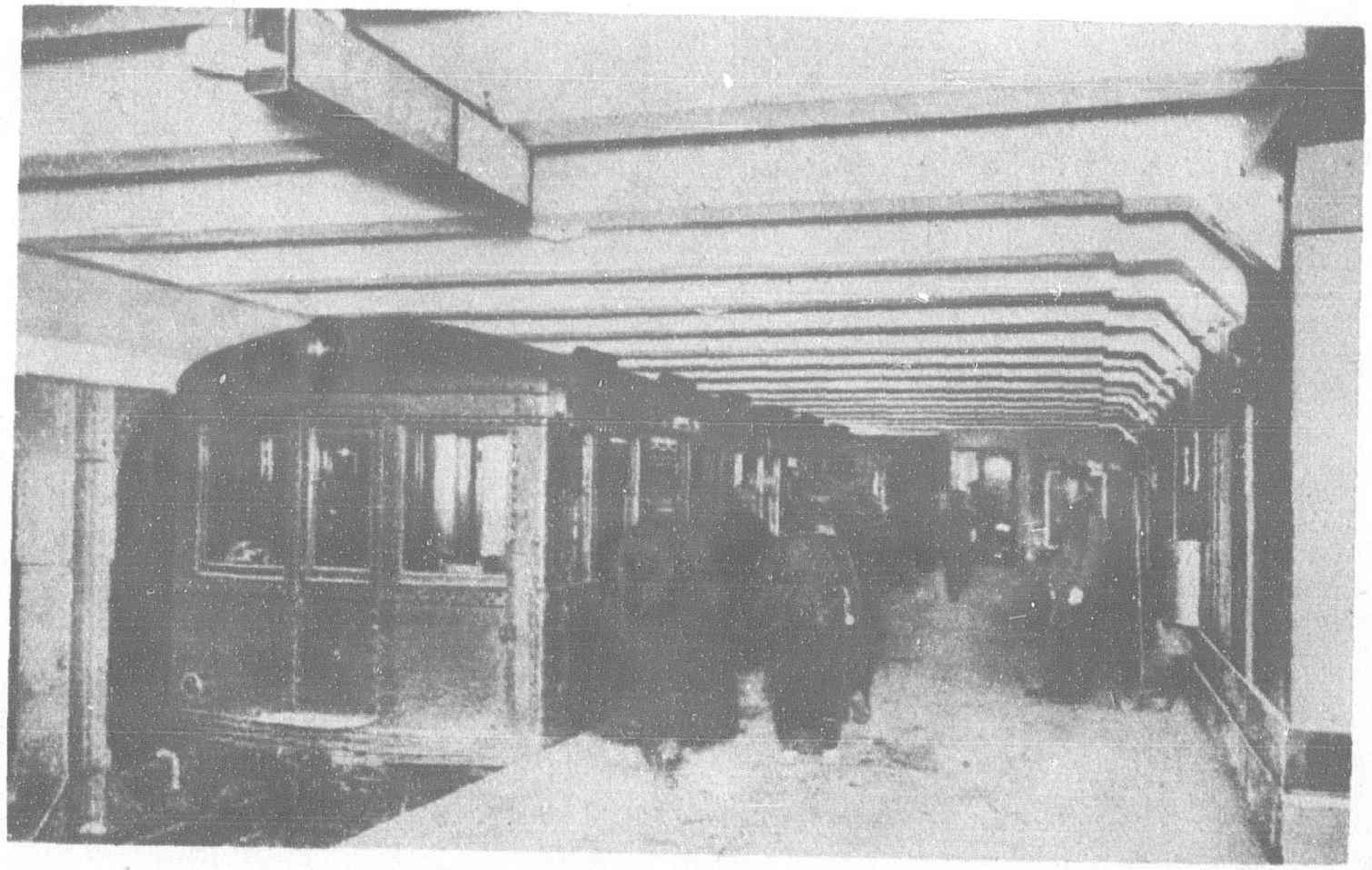
Preliminary geological investigations had already been made, the general plans completed and preparations for starting the work finished, when the great earthquake and fires of 1923 put a sudden check to the further progress of the work. However, as it was found advantageous to commence the work simultaneously with the reconstruction on the surface, the work of the first section, 1.4 miles from Asakusa to Uyeno, was begun in 1925.

The date of the commencement of the work in the first section was September 27, 1925, which, it is interesting to note, fell on the centenary of the first trial operation of the first steam train in the world conducted by George Stephenson between Stockton and Darlington in 1825. This curious interweaving of Japan of the East and England of the West in the matter of railway enterprise is further intensified by the fact that the first steam railway in Japan, the line between Yokohama and Tokyo built in 1883, was executed by British engineers.

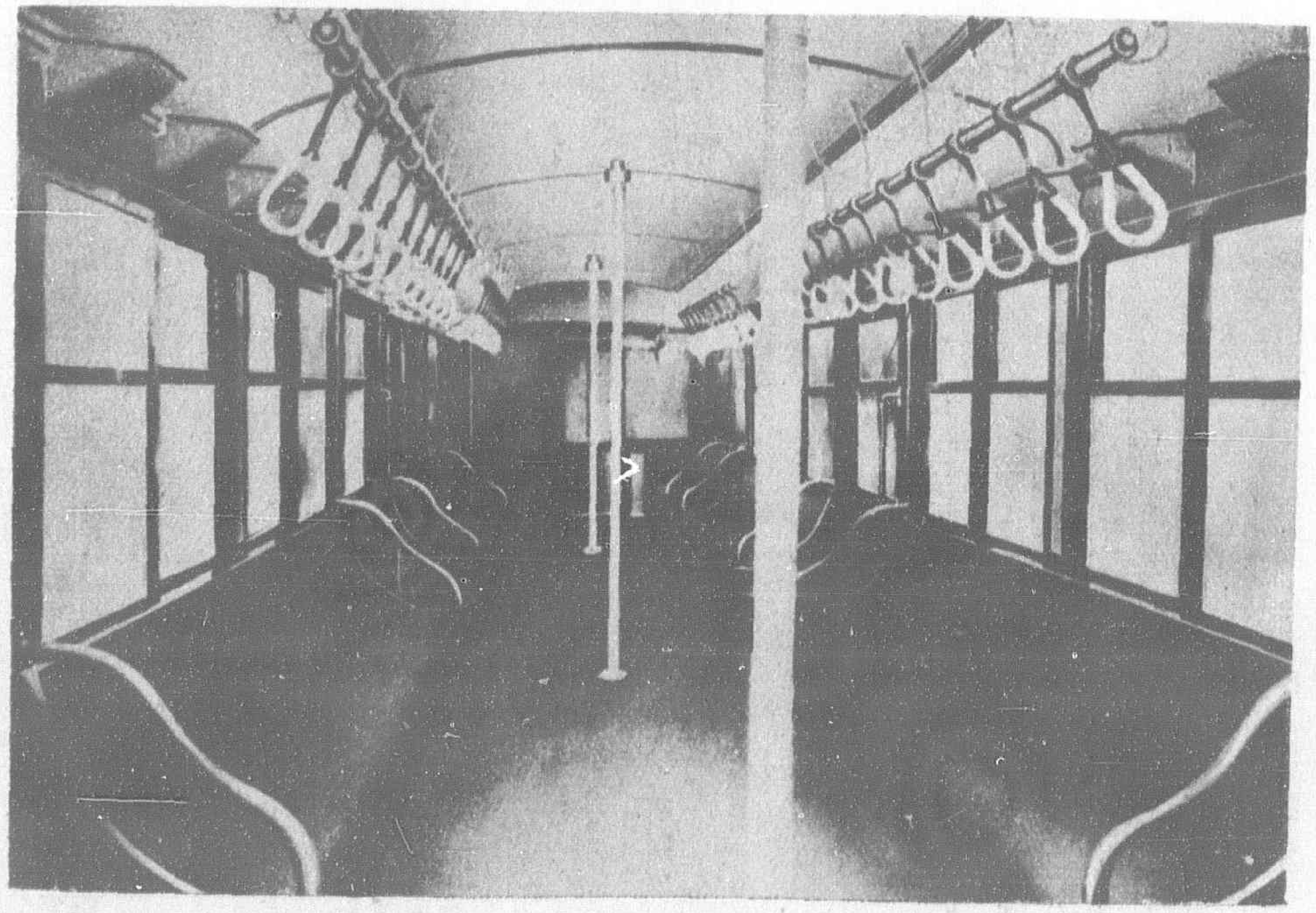
The work of construction went on smoothly and the Asakusa-Uyeno section was opened for traffic in December, 1927. Uyeno station on this section has traffic connection with the Government elevated railway and the Government railway to Nikko and northern



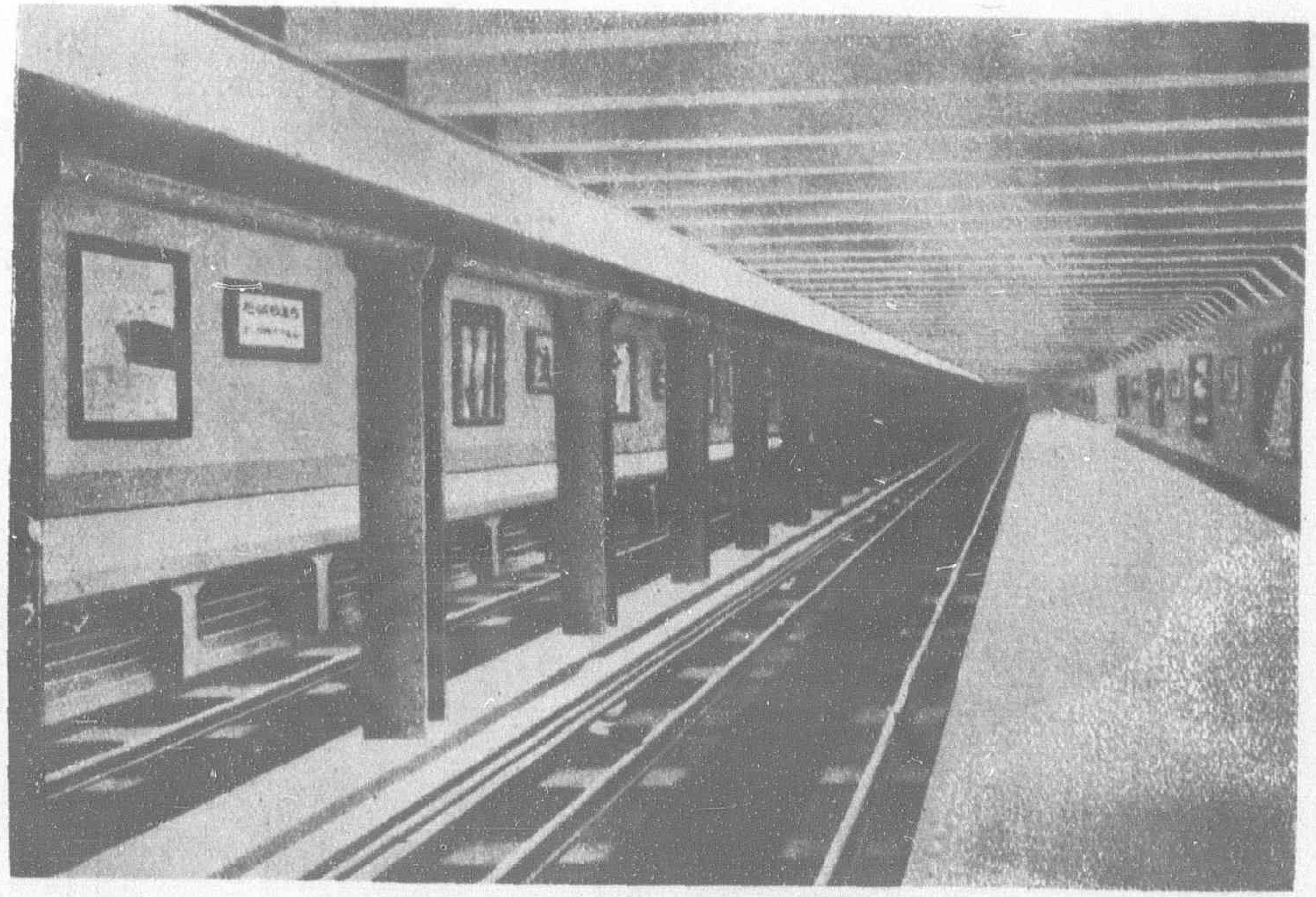
Showing Street Entrance to Subway



Boarding Subway Train



Interior of Typical Subway Car at Tokyo



Showing Subway Station Platform

Japan. The northern terminal Asakusa station is now undergoing extensions to platforms and passages to connect with the electric railway terminal of the Tobu Railway Co. Escalators are to be installed at the latter terminal.

The second section, 1.1 miles in length, was begun in 1927, and opened at the beginning of 1930. The third section half a mile long, including Kanda station connection with the Government elevated railway, has now also been completed. The line is to be gradually extended southward and work will also proceed from the other terminal. Tokyo municipality has decided to construct a network of subways at Tokyo with a total mileage of about 50 miles and the Company's line forms a part of this subway system.

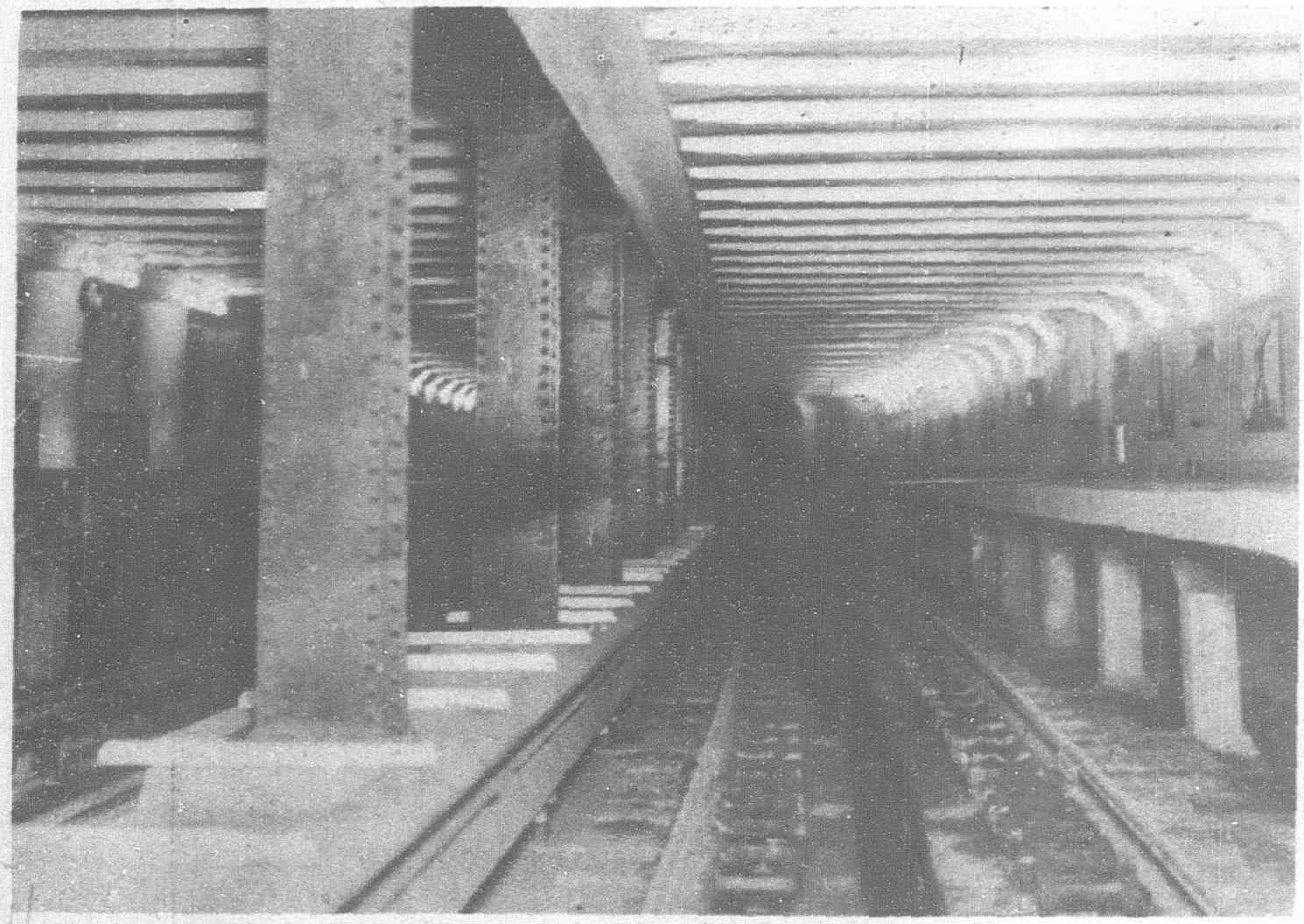
The newly completed section of the subway between Manseibashi and Kanda, a distance of about 0.55 kilometers in length is to be opened officially on December 1.

The Kanda Substation constructed at the same time is situate near the farther end of the new extension line, and has many interesting features.

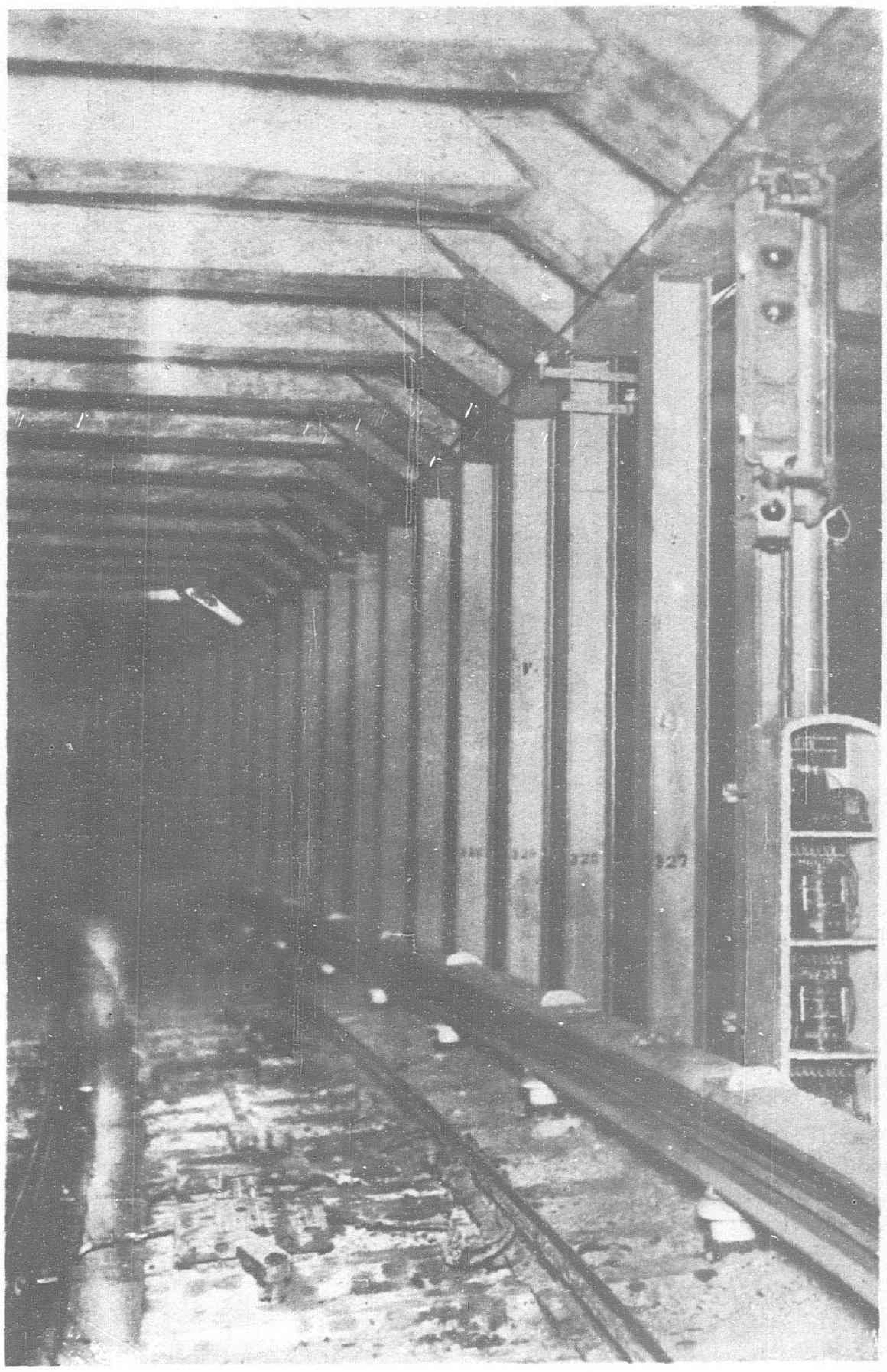
In the first place, two sets of 1,000 kw. mercury rectifiers installed in the substation, are the first mercury rectifiers installed in subway substations in Japan, and are to be controlled from the Ueno Substation, by means of the supervisory control equipment. The supervisory control of the mercury rectifier is also the first attempt in this country. It is to be noted that this substation was designed for a capacity of 2,000 kw., but for the time being, the machines will be operated under a light load. Consequently, the rectifiers were designed so as to maintain high efficiency for a wide range of load, and the efficiency at a quarter of full load is about 93 per cent.

One of the features is that the cooling oil is entirely dispensed with for the equipment used in view of the fire accidents in subway substations experienced in foreign countries. The 2,000 kw. transformer installed in the substation is of the air-blast type. Compared with the oil-cooled transformer, the height of air blast transformer is considerably low and the space utilization is much better. The voltage of the transformer is 20,000 V, which is the highest for air blast transformers installed in this country. The air for the cooling blast is treated by the air filter before being used. The Lux fire extinguisher is also adopted as means of protection in case of an emergency, to be immediately operated by the thermostat, when the ambient temperature rises above the fixed degree. The B.T.H. metal-clad switchgear is installed for controlling the incoming feeder.

The mercury rectifiers, D.C. switchgear and air blast transformer were manufactured by the Shibaura Engineering Works, and the supervisory control equipment was manufactured by the Nippon Electric Co., who supplied most of the supervisory control equipments installed in several other places in this country.



Interior View of Tunnel at Station



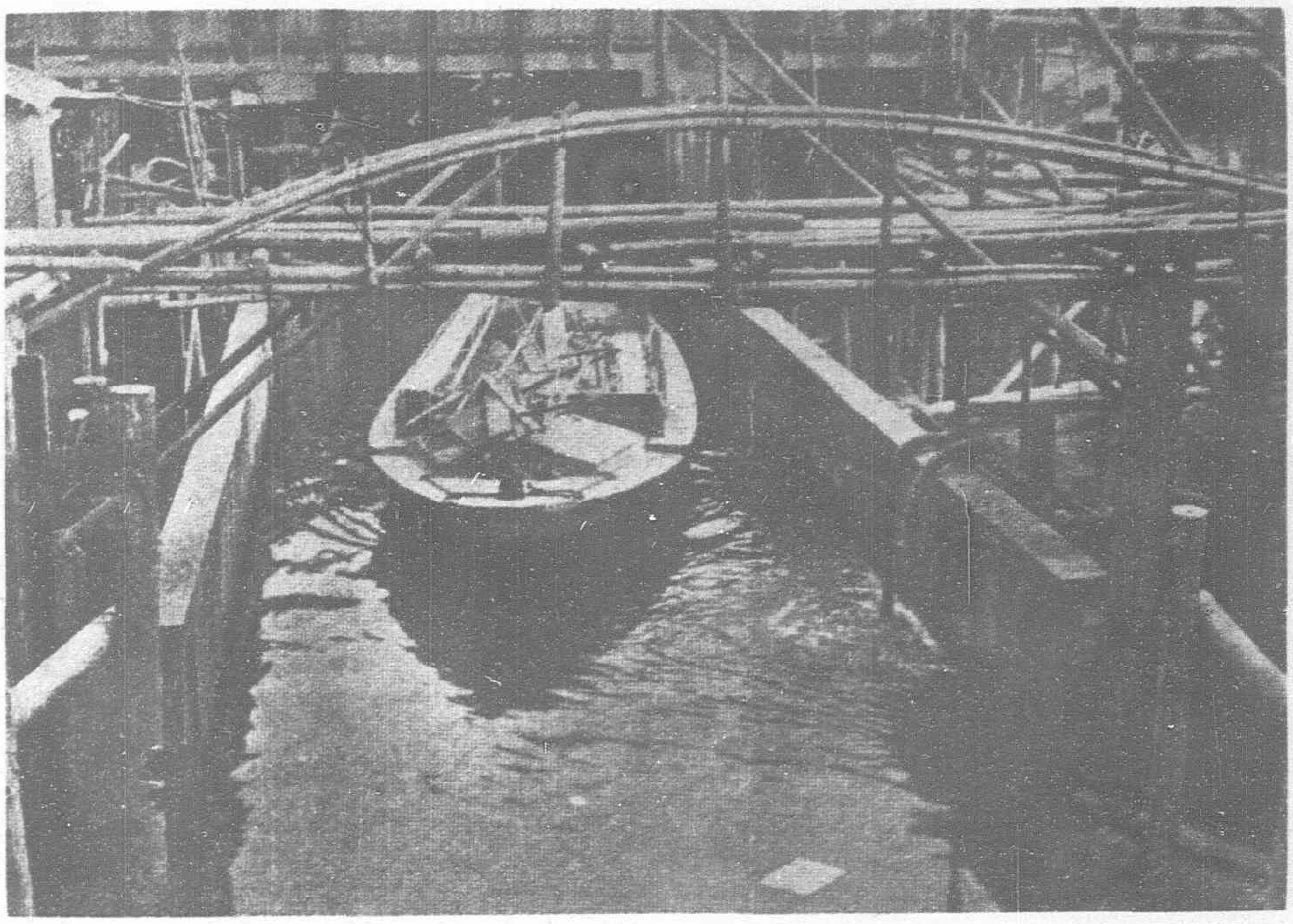
Double Line Subway Tunnel Track with Third Rail and Signal

Completion of the new section brings the total length of the subway to something more than 4.4 kilometers and work on further sections is being actively carried forward.

The tunnel constructed immediately below the street, is of the double track box type with a steel frame supported by reinforced concrete. Stations also of the box shape are provided at intervals of about half a mile, with platforms 300 feet long. The depth from the street to the platform level is less than 30 feet, stairs being provided for the use of passengers. The track has a gauge of 4-ft. 8½-in. The rail weighs 100 lbs. per yard and the conductor rail weighing 90 lbs. per yard is of the upper contact system.

At the terminal stations, electrically worked crossings are provided, which are interlocked with the signalling system. All signalling appliances are automatic and interlocked with automatic train stoppers, as the cars in time of heavy traffic may run at intervals of one and a half minutes. Cars are all of the steel bogie type, 50 feet in length by 8-ft. 6-in. wide and are equipped with two 120 h.p., motors and with indirect lighting. Electric substations are to be provided at distances of about one mile along the route and will be constructed either above or below ground.

A single track car shed line branches from Uyeno station, and on emerging to the surface, connects with an electric substation and a temporary repair shop. The substation plant consists



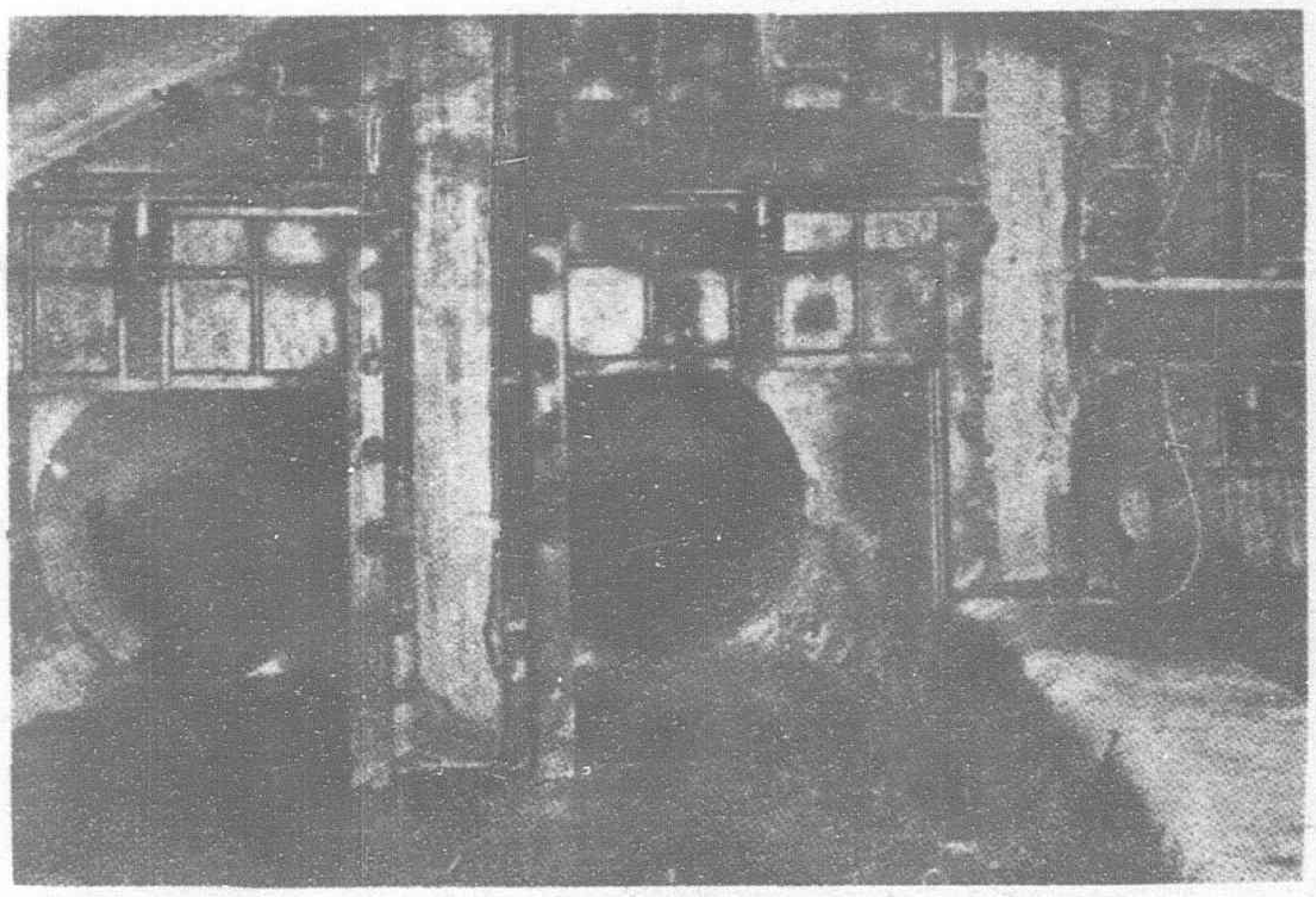
Steel Trough on Bed of River Kanda

of two rotary converters with a capacity of 1,000 kw., which transform current received from two different sources into 600 B. direct current. For lighting, the power is obtained from three different sources to secure absolute safety. The interior arrangement of stations, construction of track, and ventilation holes, etc., are mainly modelled after those of New York subway, but such features in subway construction in other countries as have been thought desirable have also been incorporated.

In tunnelling the open cut and decking system has been used. It consists of I steel piles driven into the ground on both sides of the tunnel and I steel girders topping as beams. The invert to the tunnel is, in the meantime, covered with planks so as to serve as a temporary support for the road surface. Excavation is done beneath the decking and the earth is carried up by means of skips or bucket conveyors. When the desired depth is attained, a box shaped steel frame with steel column in the middle is erected, and reinforced concrete covers the frame. The tunnel is made waterproof by a layer composed of asphalt felt or jute burlap with asphalt on the outside. The steel piles are then extracted and the road beams taken off for further service after filling up the completed tunnel.

With regard to the geology of the city of Tokyo, the lands approaching the coast or the low region bordering on the River Symida are formed of a precipitated stratum, while the whole region in the west belongs to the tertiary. The precipitated stratum being of compact condition is wholly of clay or clay mixed with sand, and at some places there are pebbles several feet below the surface soil with little outflowing of water. In the first section of the subway at Kikuyabashi, in order to avoid deep depression of the subway to pass under a sewer pipe, a syphon with three rows of steel pipes was constructed. The sewer pipe of reinforced concrete, semi-circular in shape, 6-ft. wide and 5-ft. high in inner dimension. One of the syphon steel pipes is 2-ft. 6-in. diameter and other two 3-ft. 6-in. each. They are so laid that the small pipe is to be utilized for ordinary water flow and the large pipes for flood overflowing at the intake.

In the third section the subway passes under the River Kanda. This part of the tunnel, 150 feet long, was built directly under the bridge simultaneously with the restoration work of the highway bridge. An interesting feature of the work at this point was the method for dealing with the stream which was accomplished by the construction of a steel trough 60 feet long, 11 feet high and 20 feet wide. Sheet piles were driven in the river bed at both ends of the trough, and dams composed of sheet piles and puddle were constructed enclosing the site which formed a basin to receive the steel trough.



Construction of Syphon, showing three-feet six inches diameter steel pipes

Water in the basin was pumped out, and abutments formed of wooden blocks and concrete were prepared to set the trough. The steel trough was set in the basin, and the dams surrounding the trough were taken off. New dams were built on both sides of the trough so as to lead the stream to the trough and open cut excavation was executed by sheet piling method. The steel frame for the subway tunnel was then erected and upon it a flat arched highway bridge with an 80 feet span was constructed.

In the same section, adjacent to the southern end of the River Kanda tunnel, a short section of 400 feet was designed to make the double line arch shaped tunnel by tunnelling method, but the surcharge being only 20 feet, it was found unsuitable to adopt the ordinary method of mountain tunnel excavation. To avoid depression of the road surface above the tunnel during the construction, excavating method by headings only was selected.

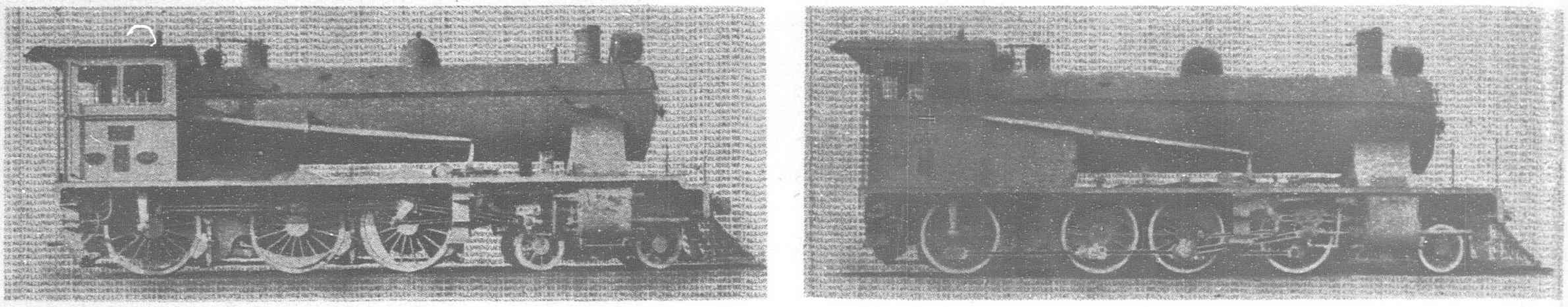
The sidewall bottom heading was first excavated and filled with concrete, and next the heading along the structure on the bottom heading was excavated and concreted, the same method being repeated upward, and nine headings and nine concretings finished the side wall and arch part of the tunnel. The core is then taken off, and the invert concreted. This part of the tunnel is now well under construction.

In the same section, the Government elevated railway bridge pier stands close to the tunnel, which is now under construction on the system. The bridge pier stands on foundation concrete piles projecting above the level of the tunnel roadway. For the protection of the pier, concrete columns were built close to the bridge pier, while wooden grillages standing on the columns support the plate girders; this is one example of under-pinning.

The main feature characterizing the construction of the subway and one which has been borne in mind throughout in determining its design is the fact that it has to be capable of resisting the action of violent seismic disturbances to which this part of the world is liable.

Much was learned from the damage caused by the great earthquake of 1923, and since this time seismologists, geologists and civil engineers have carried on intensive studies for determining the extra load factor required in structural design to withstand earthquake shocks. This was the prime factor which resulted in a rigid frame structure for the tunnel body of the subway being adopted.

The principal personnel responsible for the design and construction of the Tokyo subway are as follows:—Dr. R. Nomura, President; T. Hayakawa, Managing Director and Founder of the Tokyo subway; Y. Aiko, General Manager; Y. Totake, Chief Engineer; A. Hayashi, Chief of Electrical Department.



Types of locomotive supplied for the Lunghai Railway by the Belgian Compagnie General de Chemins de Fer and Tramways en Chine. At left a "ten wheel" 4-6-0 compound passenger locomotive; at right "Consolidation" 2-8-0 freight locomotive

More Work on the Lung-Hai Railway

By KINGWELL J. TSHA

THE Lingpao section of the Lung-Hai Railway runs westward along the Yangtze River from Lingpao to Tungkwan *via* Wensianghsien, Kiaopan and Pantaochun, a distance of 70 *kung li* (kilometers). The country through which this section of the railway passes is very mountainous, and consequently the building of many tunnels is necessary and numerous bridges have to be constructed in order to shorten the line as much as possible. The longest bridge is at Kienho, near Henkoukwan, the next in size being those at Wensien and Wentichun.

The building of the Lingpao-Tungkwan section was started about seven years ago. After completion of the Kwanyintan-Shenchow and Shenchow-Sian sections, construction work on the Lingpao-Tungkwan section was begun, in the hope that the entire Lung-Hai line would be soon in operation, but progress has been much slower than anticipated, and the Lingpao-Tungkwan section was not completed until last year (1930), the cost of construction amounting to over $10,000,000.

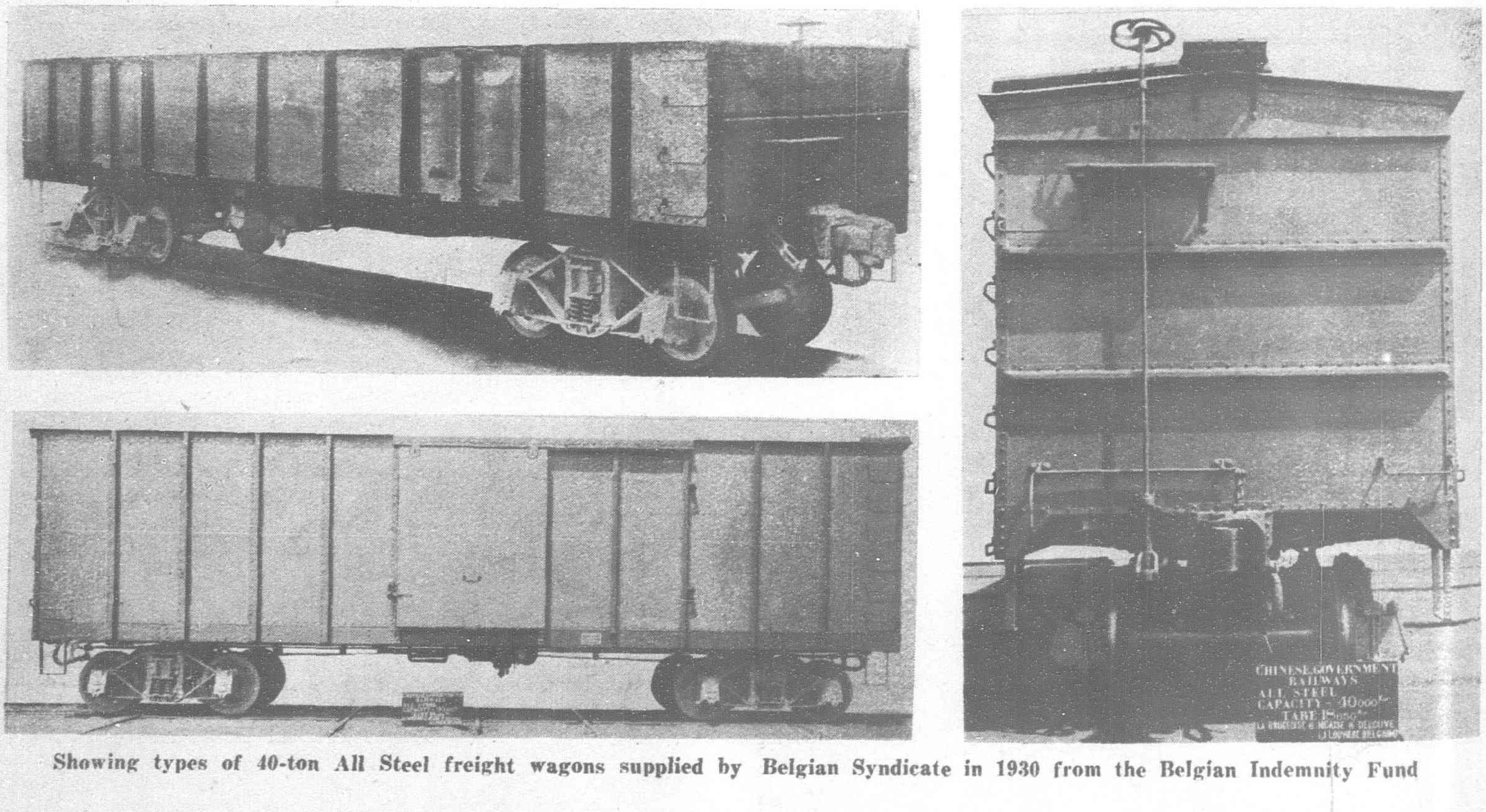
Along the Lingpao-Tungkwan section there are many curves varying in radius from 350 to 2,000 *kung chih* (meters). The biggest gradient on this section does not exceed 1 in 100. There are 11 tunnels along the section, and the same number of stations, as follows: Lingpao, Chiaochuyichuan, Changkiawan, Yihchuan, Wensien, Kaopan, Pantouchan, Chiaochuyichuan, Wentichen, Chiacchuyichen and Tungkwan.

The total length of embankment erected along the Yellow River for protection against floods amounts to 1,200 meters.

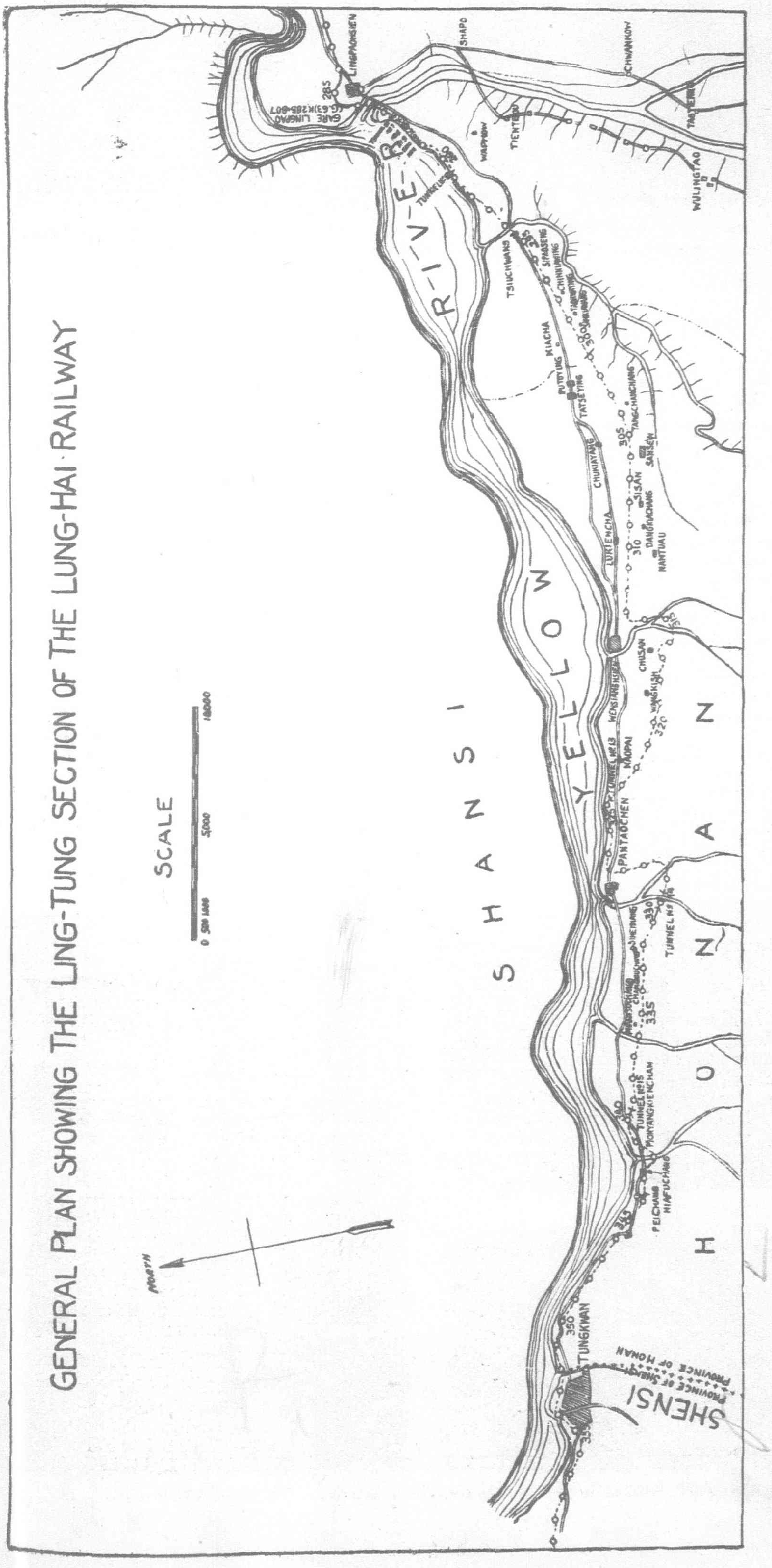
Ferro-concrete has been very largely used in the building of bridges and similar constructional works. The proportion of cement, gravel, sand and lime varied according to the purpose for which cement or concrete was to be used. The following are the various grades and their components:

CEMENT.

Grade	*Sand* *(Cubic meter)*	*Lime* *(Cubic meter)*	*Cement* *(Barrels of 170 kilo)*
A	1	0.50	1
B	1	0.50	1
C	1	0.50	1½
D	1	0.50	2
E	1	0.50	2½
F	1	0.50	3
G	1	0.50	3½
H	1	0.50	4½
I	1	0.50	5
J	1	0.50	5½
K	1	0.50	6½



Showing types of 40-ton All Steel freight wagons supplied by Belgian Syndicate in 1930 from the Belgian Indemnity Fund



GENERAL PLAN SHOWING THE LING-TUNG SECTION OF THE LUNG-HAI RAILWAY

CONCRETE.

Grade	*Gravel* (*Cubic meter*)	*Cement* (*Quantity and Grade*)	
b	1	0.60 (cubic meter)	B
c	1	0.60 ,, ,,	C
d	1	0.60 ,, ,,	D
e	1	0.60 ,, ,,	E
f	1	0.60 ,, ,,	F
g	1	0.60 ,, ,,	G
h	1	0.60 ,, ,,	H
i	1	0.60 ,, ,,	I
j	1	0.60 ,, ,,	J

There are nine large bridges along the Ling-Tung section and many smaller ones. The big bridges are as follows:

		Cost
Lingpao	... ...	$99,195
Chusong	... ...	110,220
Wensien	... ...	43,583
Pantou	(No. 1)	55,000
,,	(No. 2)	57,661
Wentichen	(No. 1)	70,000
,,	(No. 2)	50,061
Tungkwan	(No. 1)	22,000
,,	(No. 2)	35,000

In driving tunnels the cost naturally varies with the nature of hills to be pierced, ranging from $250 to $300 per *kung chih* or meter. The following are the detailed figures for building tunnel No. 17, near Tungkwan, showing the cost per *kung chih*:

Boring	$76.00
Cement and Bricks	60.19
Tunnel (roof and sides)	62.24
Tunnel (base)	28.98
Gravel	4.82
Sand	2.40
Woodwork	16.00
Labor...	13.51
Miscellaneous	13.20
Total	$277.34

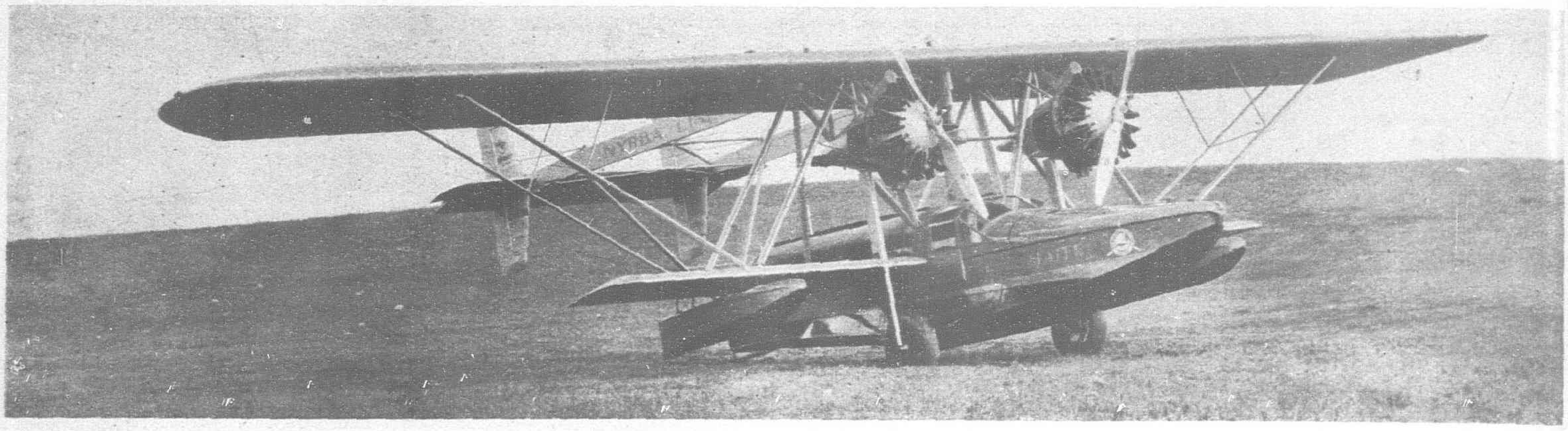
Along the section there are 11 tunnels, brief particulars of which are as follows:

Tunnel No.	*Length (meter)*	*Cost*
6	90.50	$26,955
7	621.20	163,685
8	90.30	33,320
9	107.40	37,943
10B.. ...	2,800.00	988,000
12	622.60	176,741
13	695.00	172,000
14	631.84	147,000
15	395.00	95,320
16	909.10	227,500
17	1,080.00	324,000

Tunnels No. 10 and 11, owing to their proximity to the Yellow River, were exposed to the danger of flooding, and have collapsed or been damaged to such an extent as to prevent their use for the time being. However, means of communication have to be maintained and the building of a temporary line is necessary, the cost of which is estimated as follows:

Levelling	$4,200
Drainage	40,800
Conservancy	3,000
Embankments	80,000
Building track material and labor	65,000
Miscellaneous	7,000
Total	$200,000

(*Continued on page 621*)



The Sikorsky Amphibion S-38

Chiang Kai-shek's Flying Ship

By HARRISON FORMAN

The right of the airplane to compete with the automobile, the railroad and even shipping is fast becoming firmly established in the minds of transportation experts. Too, there is the added advantage of speed, which in itself is a factor of considerable importance. However, owing to the high value of real estate, landing fields must of necessity be at a considerable distance from the business and residential centers, and the time it takes to travel to and from these fields must be added to the actual time of flight.

Coming of the Amphibion

The fact that most cities are in close proximity to rivers, lakes, bays or ocean harbors offered a solution to the landing field problem. The development of the seaplane came first, to be closely followed by the more efficient amphibion. The amphibion remains unquestioned in its claim to being the most satisfactory form of air transportation from the standpoints of safety, performance and economy. Besides having at its disposal the landing fields of the landplane as well as the seaplane, every body of water of a few hundred square feet in area becomes a potential airport. When the contingencies of forced landings are considered, this cannot be overstressed in its influence upon the factor of safety of the amphibion as a medium of air transportation.

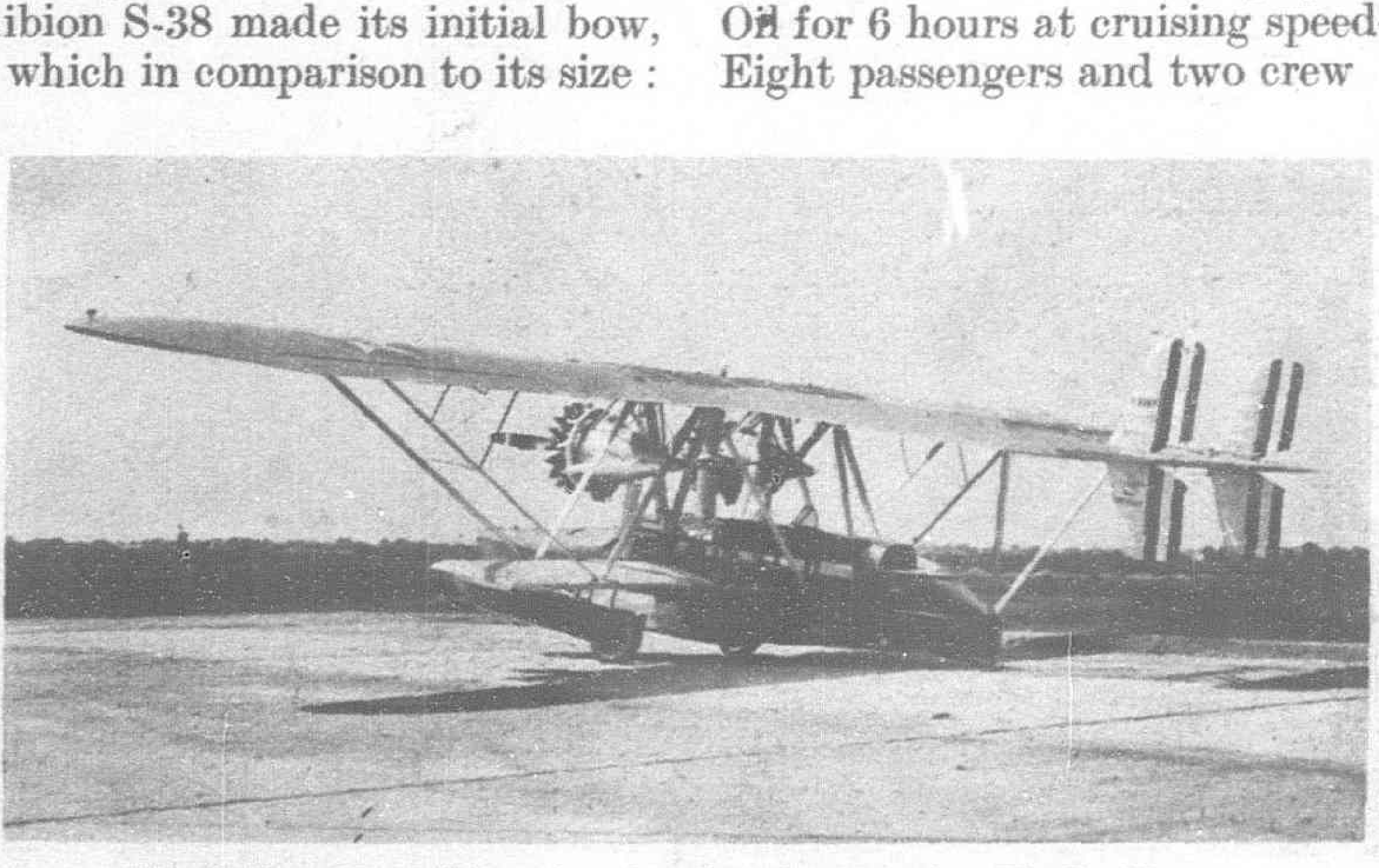
The Sikorsky S-38

Recognizing this postulate, Mr. Igor I. Sikorsky, who has been actively engaged in the aircraft industry since 1908, has concentrated all his energies and abilities toward the development and perfection of an amphibion which in technical design and production has been universally recognized as pre-eminent in flying qualities, load carrying, handling on land and water and safety. When the Sikorsky Amphibion S-38 made its initial bow, it was the first and only amphibion which in comparison to its size :

1. Flew as well as the best landplane.
2. Flew as well as the best seaplane.
3. Had two lateral engines and could be perfectly controlled on the water.
4. Could be jacked up and lowered by its own landing gear.
5. Could fly on either of its two engines.

Accepted by U.S. Navy

The first S-38 was delivered to the United States Navy for tests in 1928. The results so far exceeded everything theretofore thought possible in amphibion development, that the U.S. Navy now has S-38's in continuous service for reconnaisance, for carrying officers and personnel to and from the fleet, and for rushing the sick and injured to shore hospitals for emergency treatment. In maneuvers off Panama, a Sikorsky was successfully used in " bombing " the Gatun Locks. The U.S. Navy has done much to exploit the uses to which a Sikorsky may be put, so that to-day the demand for the S-38 comes not only from America but from foreign countries, and represents every class of purchaser from the extensive use by the Pan-American Airways, operating an air line from the United States to Central and South America, to private air yachts, and air-taxi work in and about the larger and more progressive cities. Recently, two Sikorsky S-38's were purchased by the National Government of China, one for flood relief service and another for the personal use of President Chiang Kai-shek.



Sikorsky Amphibion in the Service of the U. S. Navy

Performances

All performance data was obtained from flight tests. (The setting of propellers remained the same during all tests.)

With useful load of 3,800 lbs.

High speed—over	125 m.p.h.
Stalling speed	55 m.p.h.
Cruising speed at sea level @ 1,750 r.p.m.	110 m.p.h.
Initial climb	750 ft./min.
Ceiling	18,000 ft.
Take-off time from land	12 sec.
Take-off time from water	18 sec.

Distribution of load for a flying range of about 600 miles

Ship empty	6,000 lbs.
Gas for 6 hours at cruising speed—264 gals.	1,584 ,,
Oil for 6 hours at cruising speed—16 gals.	120 ,,
Eight passengers and two crew	1,700 ,,
Standard and extra equipment of boat and passenger luggage	576 ,,
Gros weight as per Department of Commerce Certificate No. 126	10,480 lbs.

Standard Equipment

2—Wheels with Brakes
2—Propellers, Hamilton Metal
2—Hand Inertia Starters
2—Pilot's Safety Belts
2—Dome Lights in Cabin
6—Ash Receivers in Cabin

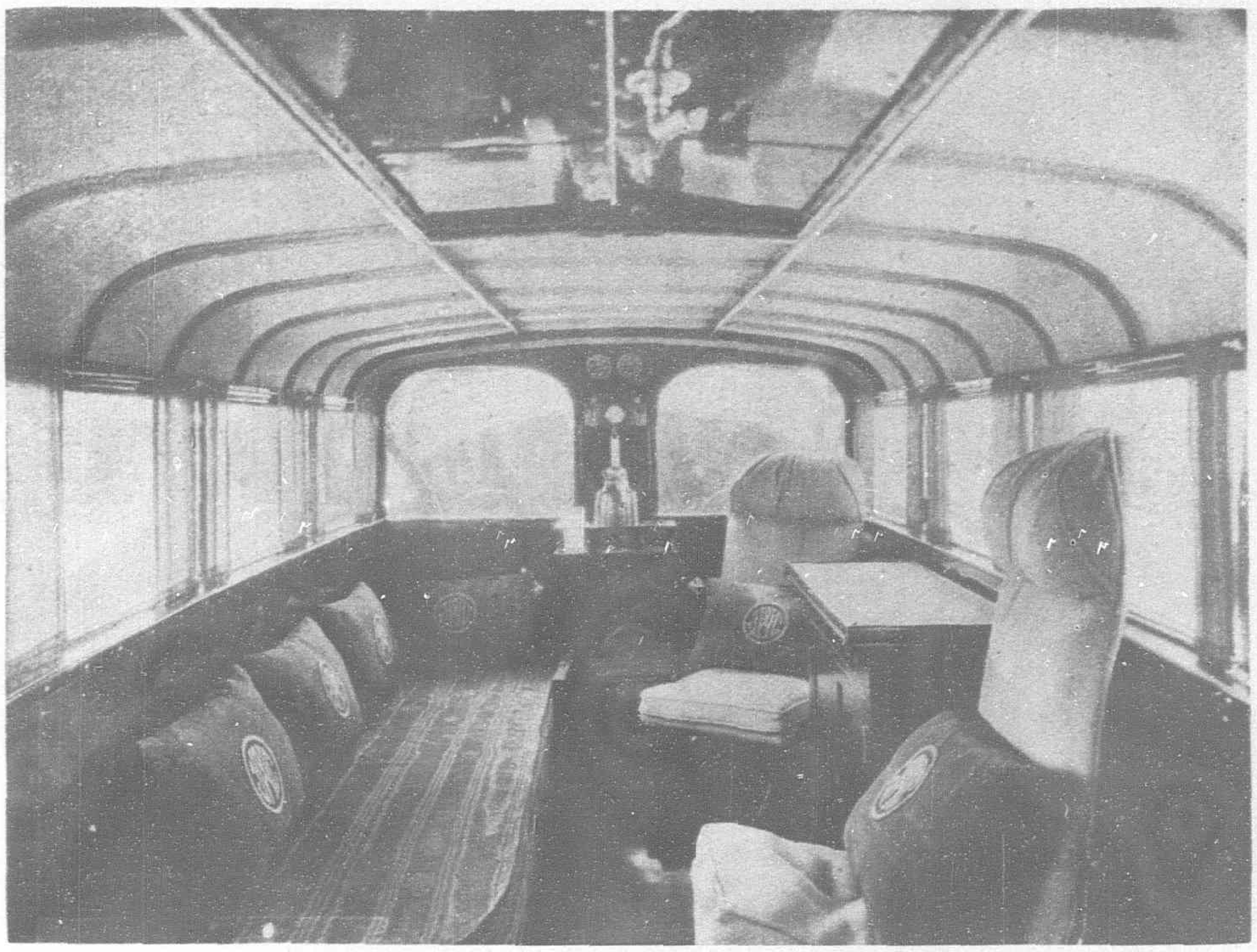
1—Magnetic Compass
1—Altimeter
1—Air Speed Indicator
1—Bank and Turn Indicator
2—Oil Pressure Gauges
2—L. G. Oil Pressure Gauges
2—Oil Thermometers
1—Inclimeter
1—8-Day Clock
2—Tachometers
2—Magnetic Fuel Gauges
1—Set (3) Navigation Lights
1—Riding Light
5—Light Switches for Instrument Board
1—Master Switch
2—Scintilla Engine Switches
2—Hot Shot Batteries
2—Hand Fire Extinguishers in Cockpit
2—Hand Fire Extinguishers in Cabin
2—Windshield Wipers
8—Passenger Seats
2—Pilot's Seats with Cushions
8—Passenger Safety Belts
1—Aerokit
1—Seat Cushion (extra)
1—Toilet
1—Anchor
150′ Manila Floating Rope
50′ Heaving Line
1—Portable Bilge Pump
1—TB Boat Hook
2—Canvas Fenders
1—Raw Hide Bow Fender
1—Canvas Water Bucket
1—Towing Sling
1—Mooring Sling
1—Hand Stroke Air Pump
1—Tire Valve Extension
1—Toolbox, with Tools
1—Toolkit
1—Engine Instruction Book
1—Toolkit } In Package for Ground Service Only
1—Engine Instruction Book } In Package for Ground Service Only
1—Airplane Instruction Book
2—Engine Log Books in Bag
1—Airplane Log Book
2—Engine Covers
1—Two-piece Hull Cover

SPECIFICATIONS

Power plant, 2 Pratt & Whitney motors, 420 h.p. each at 2,000 r.p.m....	... 840 h.p.
Weight of plane empty	...6,500 lbs.
Weight per sq. ft. with 3,800 lbs. useful load	... 14.3 lbs.
Weight per h.p. with 3,800 lbs. useful load	12.3 lbs.

DIMENSIONS

Span	71-ft. 8-in.
Length overall	40-ft. 3-in.
Height	13-ft. 10-in.
Width of tread	9-ft. 8¼-in.
Span upper wing	71-ft. 8-in.
Span lower wing	36-ft. 0-in.
Chord upper wing	100-in.
Chord lower wing	59-in.
Dihedral upper wing	0°
Dihedral lower wing	1°
Gap	95.3-in.
Stagger	4.5°
Area upper wing (including 42.2 sq. ft. for ailerons) ...	574 sq. ft.
Area lower wing	146 sq. ft.
Total wing area	720 sq. ft.
Area stabilizer	51.4 sq. ft.
Area elevator	35.5 sq. ft.
Area fins	15 sq. ft.
Area rudders	20 sq. ft.



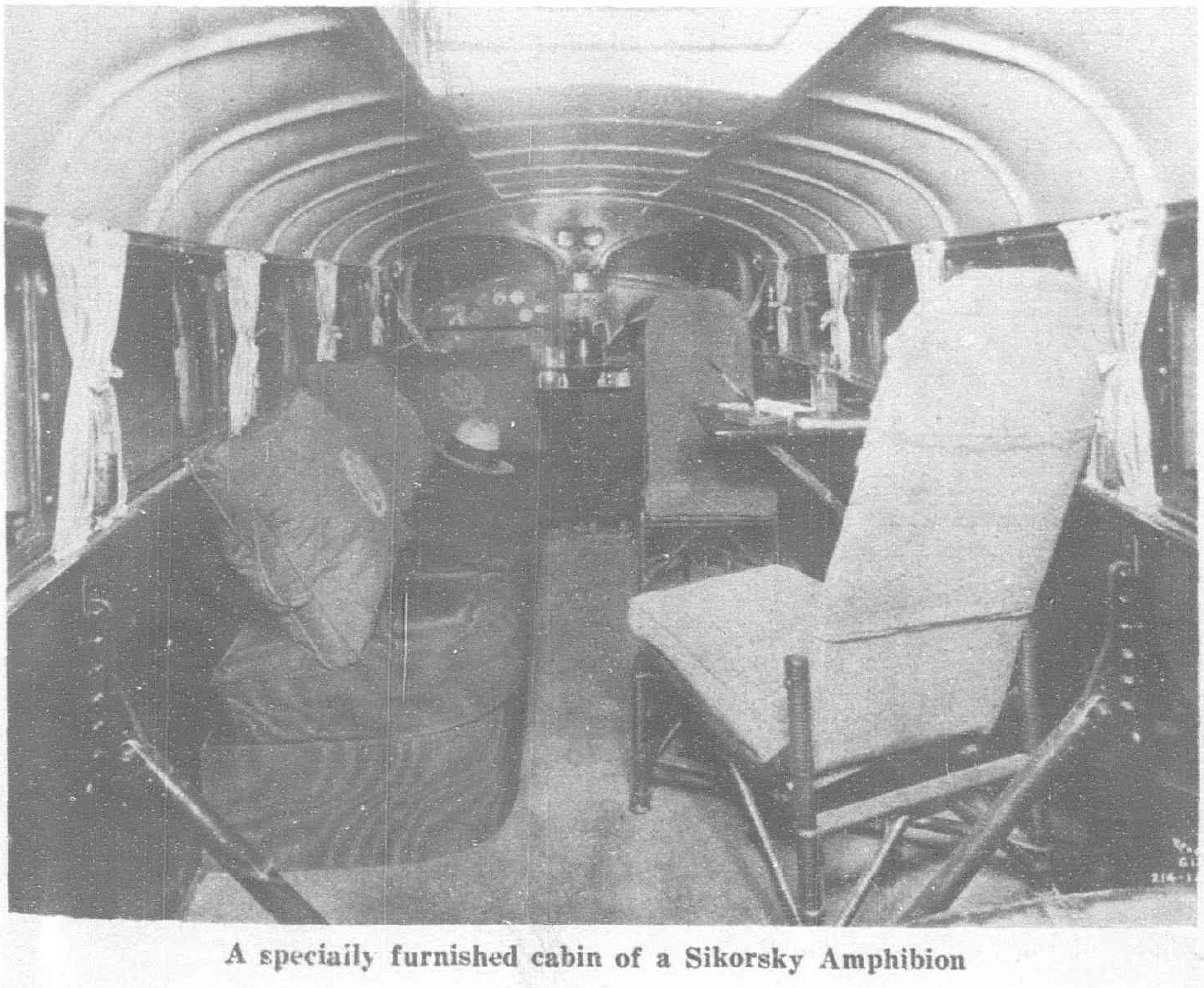
A de luxe cabin arrangement for the Sikorsky Amphibion

U.S. Government Certification

Complies with Department of Commerce regulations for landplanes and seaplanes.

It is a significant boast of the Sikorsky Aviation Corporation (a division of United Aircraft and Transport Corporation), that the Sikorsky S-38 is "The World's Safest Airplane." This is substantiated by its having the "lowest insurance rate in the world in comparison with any other plane of any type operating under similar conditions." The Sikorsky S-38 fully complies with the regulations of the Department of Commerce for landplanes and for seaplanes, and has been granted Approved Type Certificate No. 126.

The following is a listing of the particular structural features of the S-38 as given out by the Sikorsky Aviation Corp.



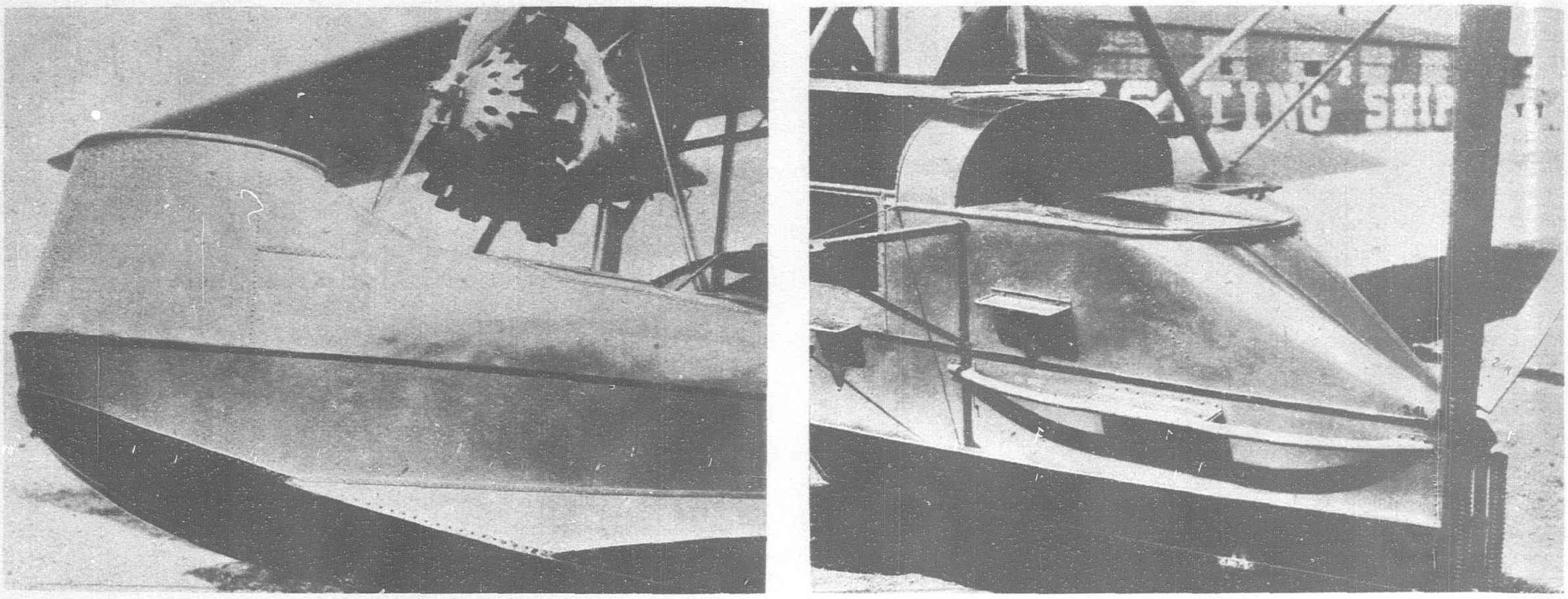
A specially furnished cabin of a Sikorsky Amphibion

General Structure

In order to fly well an airplane must avoid all unnecessary weight, but must at the same time possess the tremendous strength and durability that will enable it to meet severe and unexpected strains. Duralumin, nearly as strong as steel and almost as light as aluminum, is the material mainly employed. The method of construction is unusual for airplanes in that welding is entirely avoided. The open sections of substantial thickness are riveted and bolted together in much the same way as are the members of steel bridges and skyscrapers.

Wings

The Sikorsky Amphibion is neither a monoplane nor a biplane but is a sesquiplane. It has upper and lower wings. The upper, with its span of seventy-one feet eight inches, is nearly double the lower, which measures but thirty-six feet. The sesquiplane, developed by Mr. Sikorsky and one other designer, both working independently, has shown marked superiority over either of the other types because it retains the aerodynamic



Shows Forward Machine Gun Cockpit

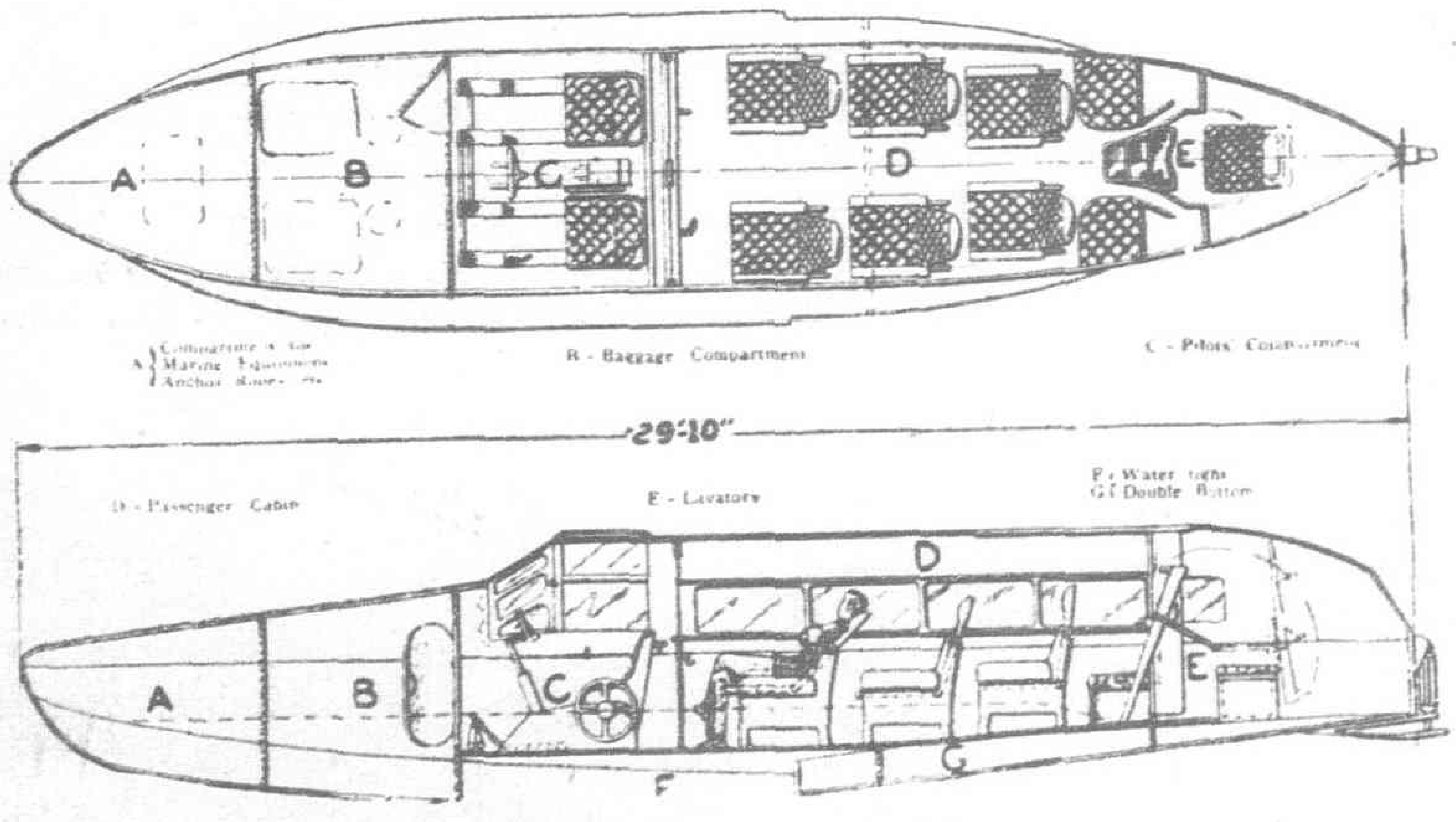
Shows Aft Machine Gun Cockpit

The pictures show how the Commercial Plane may be transformed into a Fighting Machine by Cutting Special Cockpits for Machine

advantages of the monoplane while giving the additional strength and rigidity of the biplane. This design places the major lifting surface well above the water, keeps the engines and propellers high, and allows the side pontoons to be strongly supported in a convenient position not too far from the hull.

Construction is of the metal-fabric type which extensive study, based on numerous tests and supported by direct observation of planes in service for many years and under all climatic conditions, has proved superior to the structure employing either metal or veneer coverings. The fabric covering, strongest in proportion to its weight, makes possible more strength in the interior structure, where all the stresses are taken care of by definite structural members and tie-rods. The net result is additional strength without additional weight. With the fabric covering on a metal structure the slightest distortion of parts produces well-defined wrinkles which will attract notice long before the point of danger has been reached. A thorough examination is easily made and repairs effected, when necessary, by the average mechanic.

All outside struts are streamlined duralumin and steel tubes. The ailerons, mounted only on the upper wing, are balanced, very powerful, and perfectly controlled.



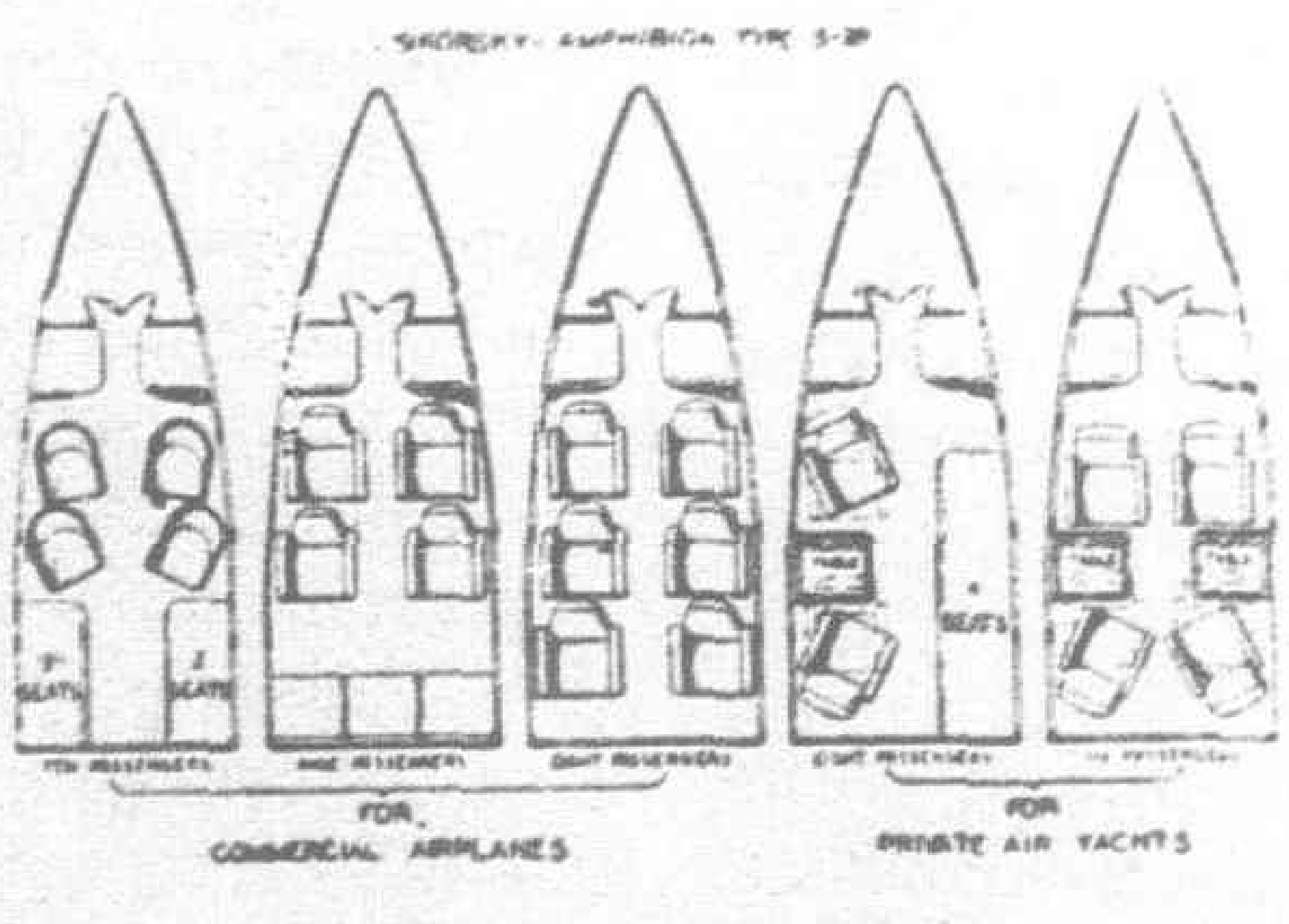
Interior arrangement of hull

Compartment A, 2,400 lbs., marine equipment; B, 6,300 lbs., luggage, mail and radio; C and D, 11,000 lbs., pilot's cockpit and passenger compartment; E, 3,600 lbs., lavatory; F and G, 2,800 and 1,000 lbs., respectively, underfloor watertight compartment.

NOTE.—Weights given indicate submerged displacement.

Stabilizer and Rudders

The empennage, or tail, the structure of which is the same as that of the wings, is attached to the upper wing by two connecting spars, forming an entirely separate unit from the cabin. This arrangement at once increases the rigidity and decreases the air resistance, and permits each of the two balanced rudders to be placed directly in the slipstream, or wind current, of the corresponding engine, where it functions with the utmost efficiency. The high position of the tail surfaces protects them from danger in maneuvering on rough water and on land. Through a simple but ingenious unsymmetrical arrangement the rudders have such a compensating action that when the plane is flown on a single engine it remains under perfect control. This rudder has been patented by Mr. Sikorsky in the United States and twenty foreign countries.



Seating arrangements

Hull and Pontoons

The hull is streamlined and of composite construction, the framework being of ash, reinforced with duralumin plates and covered with heavy-gauge Alclad sheets. It is thirty feet long with a sixty-two inch beam which is increased at the bottom to eighty-two inches by means of large sponsons.

Attached to the lower wing on each side of the hull are two all-metal pontoons. The position and displacement of these pontoons have been so studied that, being large, close to the hull, and always in the water, they instantly rectify any tendency to list, thus insuring sea-worthiness and enabling quick turns to be made on the surface of the water with but a small angle of heel.

Cabin

The interior of the cabin has been carefully designed and executed. The paneling is carried out in mahogany or walnut, the floor is handsomely carpeted, and the electric lights are couched in fixtures of approved design. No structural members enter the cabin to interfere with the arrangement of the furniture. Eight comfortable chairs, arranged in two rows, are standard equipment with air lines. The cabin, however, may be arranged in a variety of ways. Leather upholstered arm chairs, couches, card tables, cabinets, thermos bottles, vanity cases and ice boxes are available to the purchaser who desires them.

Windows are of non-shatterable glass, neatly curtained, and so placed as to permit an unobstructed view in all directions. Sliding windows separate the cabin from the pilot's compartment. A special built-in ventilating system, regulated at will, provides fresh air in any amount without draft. The cabin is entered from the hatchway by steps which, when not in use, swing back out of sight into the rear compartment. The cabin top is of the soft sound-proof automobile type.

Power Plant

Pratt & Whitney 420 h.p. (commercial rating) "Wasp" engines are standard equipment. Other engines, however, of similar type, such as Pratt & Whitney "Hornets" or Wright "Cyclones" of over 500 h.p. may be substituted, if desired, with but a slight change in structure. Metal propellers and hand inertia starters are standard equipment. The power unit may be quickly dismounted for overhauling or replacement.

Fuel System

The fuel supply is entirely separated from the cabin and the engines. All tanks are in the center section of the upper wing, where they are protected from fire, and feed the engines by the infallible gravity method. A special cross-feed valve makes it possible at a moment's notice to supply either or both engines from any or all of the tanks. The standard gasoline capacity is 330 gallons; the oil tanks carry 14 gallons each. All tanks are constructed of duralumin, riveted and held firmly in place by rigid dural "T" sections, reinforced on the inside, and fitted with large sumps, drain cocks, and special dump valves which make it possible to empty the tanks in less than 60 seconds. A special compound, insoluble in gasoline or benzol, keeps the seams tight and prevents leakage.

Landing Gear

The hydraulic-plunger mechanism of the landing gear, an exclusive Sikorsky feature, operates easily and quickly from the pilot's compartment. Its jacking power enables the fully-loaded ship to be raised or lowered while on land. The wheels may be lowered or retracted separately or simultaneously, as a variety of occasions may demand, and the change from the land position to the water position, or *vice versa*, may be made in less than 50 seconds while the plane is in operation. New multiple disc brakes, a recent Sikorsky development, now in production and being applied to all Sikorsky Amphibions, stop the ground run of the ship in less than 300 feet after landing.

The controls are designed to give the utmost convenience and efficiency. Either of the two pilot seats may be easily adjusted as to height while occupied. Between the seats are located the engine, aileron, stabilizer and landing-gear controls. The engine instruments, switches and landing-gear pressure gauges are arranged in two columns in the center of the instrument board. The control wheel may be swung in front of either pilot and locked securely in place. The dual rudder controls are provided with novel foot rests which give exceptional comfort to the pilot.

Other Features

The flight instruments are grouped in front of the left seat, from which the piloting is normally done, but can easily be read from the right side. The instrument board is carefully lighted for night flying, and all instruments have luminous dials.

In the forward compartment, which has a capacity of thirty cubic feet, is stored the marine equipment, a bronze folding anchor and line. A second compartment with a capacity of fifty-two cubic feet may be used for baggage or mail.

All lighting is by electricity supplied from dry cell batteries. In addition to the navigation lights required for night flying, a white riding light is furnished for use when the ship is moored. The airfoil section developed by the Sikorsky Aviation Corporation is the G.S. 1 so well known for its efficiency. All seats and vital parts are completely out of the plane of the propeller's rotation.

So much for what may be called on anatomical study of the Sikorsky Amphibion. One's last impression must, like his first, be that of the beauty, power, efficiency, luxury and safety of the great thoroughbred as he sees it maneuver on either land or water and then climb easily and gracefully into its favorite element—the air.

Military Uses

With its capacity to carry twelve persons the Sikorsky S-38 makes an ideal ship for established air transport, such as is certain to be developed to connect the principle ports along the China coasts. However, if required, the Sikorsky S-38 makes an excellent plane for military purposes. The cabin may be cleared and racks constructed for the carrying of quite an appreciable load of bombs. Bomb racks may be installed on the lower stub wings, near to the wing floats, or they may be constructed in a retractable manner to extend outward from the cabin. A gunner's cockpit may be cut into the nose of the hull which will give the machine gunner almost complete command of all approaches from the front, above, below or from the sides. A machine gunner's cockpit installed in the rear of the hull protects all avenues of approach from the rear.

The Sikorsky S-38 is represented in China by The L. E. Gale Company, Federal Inc., U. S. A., who are distributors for United Aircraft Exports, Inc., New York, U. S. A.

More Work on the Lung-Hai Railway

(Continued from page 617)

The rails used in constructing the Lung-Hai line are of two kinds, one supplied from the Hanyang Ironworks while the other comes from Belgium. The rails laid east of Lingpao Station are of both makes, while west of Lingpao only Belgian rails have been used. The latter are about 12 *kung chih* long, weighing approximately 42.16 kilo per *kung chih*. The following table shows the cost of rails and other material:

	Per Piece
12 m. Steel Rails	$52.90
Chairs	6.36
Sleepers (oak)	5.20
Sleepers (pine)	3.50 to 4.00
	Per Ton
Bolts and Nuts	$190.17
Fishplates	142.71
Roadbed materials	146.34
Dog-spikes	171.13
Switches (per pair)	649.69

Tungkwan Station is the largest along the line, and consists of the following buildings:

	Cost
Ticket-office	$5,000
Station-master's residence	4,000
Police headquarters	3,000
Supervisors' building	4,000
Staff quarters	1,500

Along the railway there are three water reservoirs, Lingpao, Wensien and Tungkwan. The maximum capacity of the Lingpao reservoir is 50 cu. *kung chih*, with 150 cu. *kung chih* and 100 cu. *kung chih* for Tungkwan and Wensien respectively. The cost of building the Wensien reservoir was over $5,900.

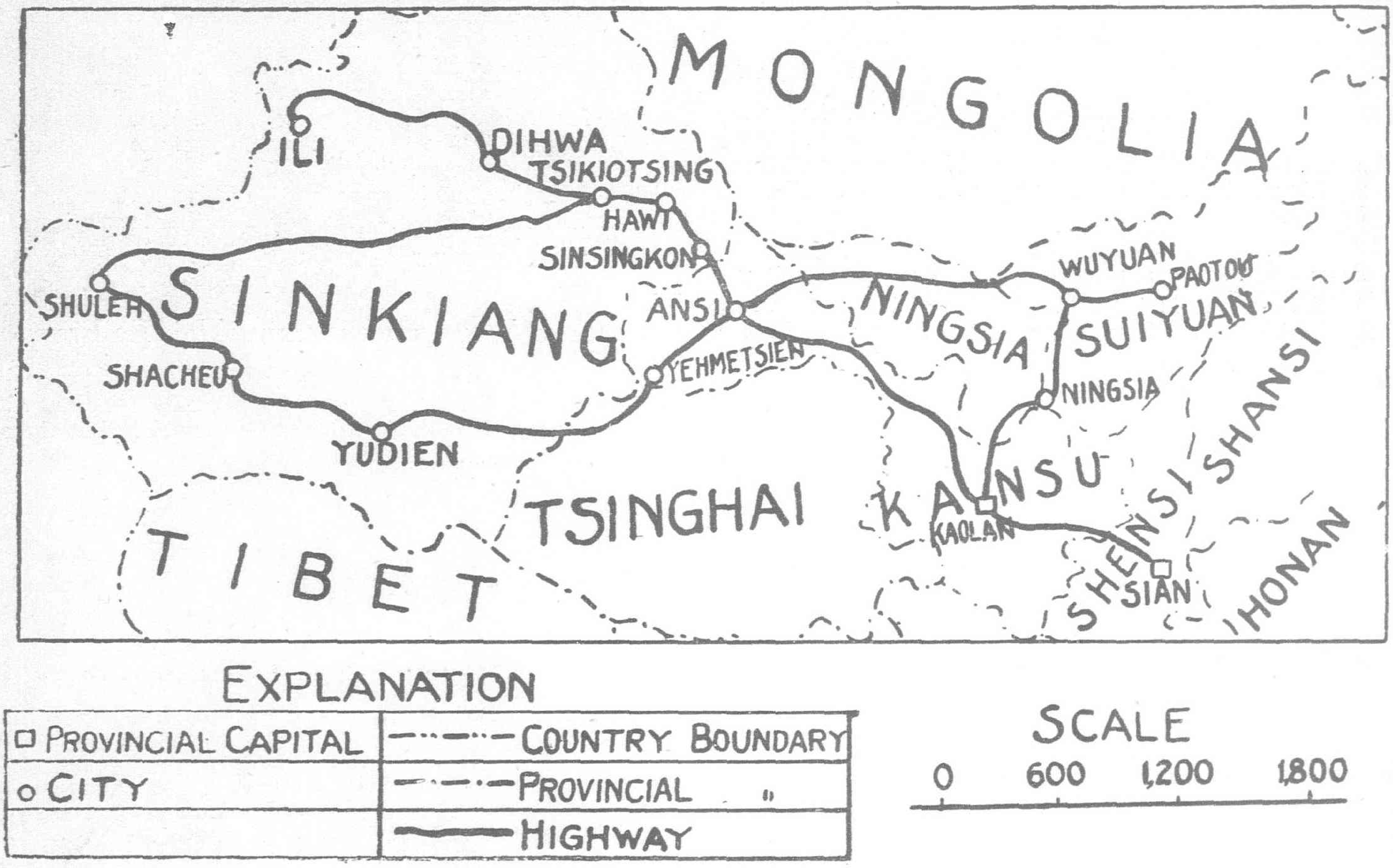
Carnegie Medal for Research Work to Skoda-Engineer

According to the report of the Iron and Steel Institute of London the great golden Carnegie Medal for Research Work was given to Dr. Em. Valenta, metallurgical Expert of the Skoda Works, Czechoslovakia. The presentation took place at London at a gathering attended by about 450 members of the Institute and prominent Representatives of Metallurgical and Research Organizations of the whole world.

Dr. Valenta is a young but well known authority in the research of metals resisting heat and corrosion and his long studies of the difficult problem, extracts of which had been published in the Memoires of the Iron and Steel Institute in 1930 under the title of "Heat and Acid Resisting Cast Irons with high Chromium and Carbon Contents" brought him to the attention of the Institute. The practical results of his research are two new alloys resistant to fire and acids, which the Skoda Works have lately brought on the market under the names of "Ferrochromit-Skoda" and "Neochrom-Skoda."

Other holders of the Carnegie Gold Medals are: Prof. Dr. C. A. Frederic Benedicks, Dr. H. C. Harold Carpenter, Prof. Dr. Leon Guillet, Dr. Percy Longmuir, Dr. J. Alexander Mathews, Mr. A. Marcel Portevin, Dr. Walter Rosenhain and a few more prominent savants.

MAP SHOWING HIGHWAY DEVELOPMENT IN NORTHWEST



Developing Highways in Northwest

By *KINGWELL J. TSHA*

Food supply problems in China—especially in time of famine—have made the question of transportation a most vital one. About ninety per cent of China's modern mileage consists simply of dirt roads. Very little gravel or macadam construction has been done, though crushed stone has been used to a limited extent for surfacing in a few provinces. Frequently it is necessary to travel and to transport freight over long distances of mud and dirt roads in order to reach the nearest railway-station. This state of affairs is very serious, as it hinders the development of commerce and disregards the comfort of the travelling public. Famine-stricken districts suffer worst of all, food and other supplies frequently arriving too late to be of service.

China's modern highways are shown in process of development in the following figures: 1921, 2,000 *li*; 1922, 14,000 *li*; 1923, 14,000 *li*; 1924, 30,000 *li*; 1925, 42,000 *li*; 1926, 47,000 *li*; 1927, 50,000 *li*; 1928, 55,000 *li*; 1929, 62,000 *li* and in 1930, 84,477 *li*. Compared with the vast area of the Republic, such a length of roadway is far from sufficient to meet requirements and inspired by the efforts of the American Red Cross to alleviate the famine-stricken districts in 1920, China has at last awakened to the urgent necessity for the construction of many more modern roads—not only larger but more suited to carry the faster and heavier traffic which results from development of motor-transport.

The National Good Roads Association of China, with headquarters in Shanghai, was organized ten years ago under the direction of Dr. C. T. Wang, President of the Association. This society has been supported by contributions from different organizations interested in its work, and by income derived from the sale of various publications. The Association has established branches in various districts, including Nanking, Soochow, Kweiyang, Changshu and Kaoyu in Kiangsu province; Hangchow, in Chekiang province; Anking and Liuan, in Anhwei province; Shangyao and Kaoan, in Kiangsi province; Hankow, Ichang, Siangyang and Wangpu, in Hupeh province; Sinyang, in Honan province; Hsienchien and Mingnan in Fukien province; Changsha in Hunan province; Peiping (the former capital); Taiyuan in Shansi province; Chengtu, Chunking, and Nankiang, in Szechuen province; Kirin, in the province of that name; Kweiyang, in Kweichow; Kweiling, in Kwangsi province and Swatow, in Kwangtung province, making a total of 27 branches throughout the country. Under the influence of the Association valuable work has been done in connection with highway construction and general development of roads in various provinces, particularly in the north-western part of the country.

New Main Roads

Recently a plan for road reconstruction has been drawn up for that district, the roads in question being the Kaolan-Ili, Kaolan-Shuleh, Paotou-Illi, Paotou-Shuleh, and Sian-Paotou roads.

Kaolan-Ili Road.—This road has a total length of 2,800 *kung li* (Kilometers), running parallel with a railway which is under contemplation.

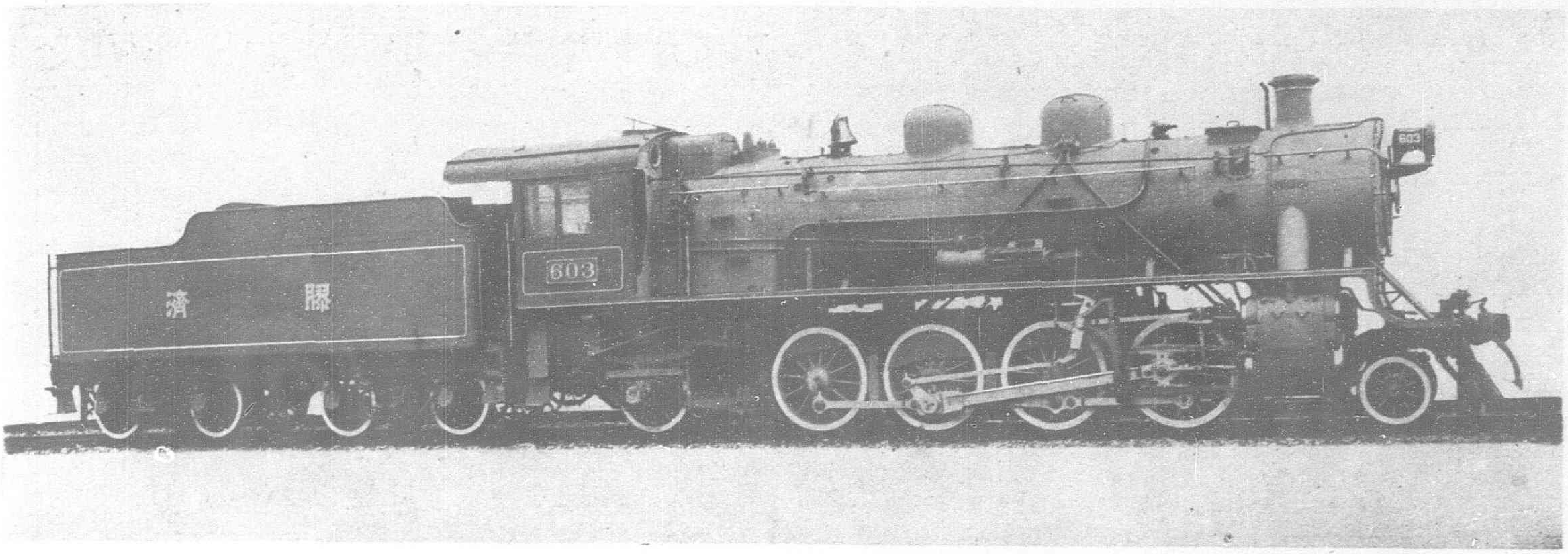
Kaolan-Shuleh Road.—This highway has a total length of 3,300 *kung li*.

Paotou-Ili Road.—This road is divided into two sections one from Paotou to Sinsinkan, *via* Wuyuan, and the other from Sinsinkan to Paotou. Each section has a length of 1,500 *kung li*.

Paotou-Shuleh Road.—This highway is built *via* Sinsinkan and Chikoutsing, and is 3,500 *kung li* in length.

Sian-Paotou Road.—Running from Sian to Paotou *via* Kaolan, Ningsia and Wuyuan, this road has a total length of 2,000 *kung li*.

(Continued on page 650).



One of the four new Mikado type locomotives

A Signal Achievement

Four New "Mikado" Type Locomotives are Built for the Chinese National Government by the South Manchuria Railway Works

In the production for the National Chinese Government of four new locomotives that have gone into service on the Kiaochow-Tsinan Line, the South Manchuria Railway Works, located at Sakako in the Suburbs of Dairen, scored a signal achievement. In the past these works largely have confined their activities to the production of rolling stock exclusively for the South Manchuria Railway, but the building of these four locomotives for the Chinese Government brings the Sakako Works into the rank of a formidable competitor of locomotive builders throughout the world.

When the Ministry of Railways at Nanking, some time ago, asked for tenders for the construction of four new locomotives to be used on the Kiaochow-Tsinan Line, the South Manchuria Railway Works obtained the contract in competition with numerous foreign locomotive builders and at an exceedingly low figure. The building of these four locomotives followed a preceding contract under the terms of which four "Pacific" type locomotives were built in 1928 for the Ssupingkai-Taonan Railway. Although the South Manchuria Railway Works have built locomotives and other rolling stock for roads in North China, hitherto the contract for the "Mikado" type locomotives on the Kiaochow-Tsinan Line was the first ever obtained from the National Government of China. Besides the low price quoted, undoubtedly another important factor in the transaction was the fortunate location of the Works at Sakako.

The contract was finally concluded on February 9, last, and the first of the locomotives produced was given a trial run on July 10, in the presence of Chinese and Japanese representatives interested. This trial run was between Sakako and Chinchou, a distance of 28.5 kilometers, and in all respects satisfactory results were obtained. The completion of the first locomotive within a period of five months also constituted a record as hitherto locomotives purchased from other builders could only be brought into service after much longer periods.

The new "Mikado" type locomotive supplied under contract has a working order of 146 metric tons, and the maximum tractive power of 16,370 kilogrammes (36,089 lbs.).

The new locomotives were handed over to the Kiaochow-Tsinan Railway authorities at Mukden and were transported over the tracks of the Peiping-Liaoning Railway, and thence over the Tientsin-Pukow Railway to Tsinan, whence they were transferred to the Kiaochow-Tsinan Line, on which they are now in service, pulling goods trains.

It is to be remarked that save for special few accessories all materials used in the four "Mikado" type locomotives are of Japanese manufacture. It is said that the tyres, wheel centers and main frames, which were manufactured by the Sumitomo Steel Works are superior to those produced in Europe and America.

The complete specifications of the "Mikado" type locomotive are given as follows:—

Mikado Type Locomotives

(English units used throughout, Metric units shown in parenthesis)

Gauge of track		14′—8½″	(1,435 mm.)
Diameter of cylinders		21″	(533 mm.)
Piston stroke		26″	(660 mm.)
Driving wheel diameter		54″	(1,372 mm.)
Boiler working pressure		200 lbs/sq. in.	(14.06 Kgs/sq. cm.)
Wheel base :	Driving, Rigid	15′—6″	(4,724 mm.)
	Engine only	31′—6″	(9,601 ,,)
	Engine and Tender	62′—9″	(19,126 ,,)
Approximate weight in working order :			
	Front truck	20,200 lbs.	(9,160 Kgs.)
	Driving wheels	143,000 ,,	(64,860 ,,)
	Trailing wheels	34,700 ,,	(15,730 ,,)
	Engine only	197,900 ,,	(89,750 ,,)
	Tender (without Stoker)	124,200 ,,	(56,330 ,,)
	Engine and Tender	322,100 ,,	(146,080 ,,)
Kind of fuel :		Soft coal	
Boiler :	Largest course, outside	72″	(1,829 mm.)
	Smallest course, inside	65″	(1,651 ,,)
Fire box :	Length	96 1/16″	(2,440 ,,)
	Width	65¼″	(1,656 ,,)
Tubes :	Number	139	
	Outside diameter	2″	(51 ,,)
	Length	16′—0″	4,877 ,,)
Flues :	Number	24	
	Outside diameter	5⅜″	(137 ,,)
	Length	16′—0″	(4,877 ,,)
Arch tubes :	Number	3	
	Outside diameter	3″	(76 ,,)
Heating surfaces :	Tubes	1,158 sq. ft.	(107.58 sq. M.)
	Flues	538 ,,	(49.98 ,,)
	Arch tubes	18 ,,	(1.67 ,,)
	Fire box	179 ,,	(16.63 ,,)
	Total	1,893 ,,	(175.86 ,,)
Superheating surfaces		458 sq. ft.	(42.55 ,,)
Grate area		43.5 sq. ft.	(4.04 ,,)

Tractive force, rated 85%	36,090 lbs.	(16,370 Kgs.)
Factor of adhesion	3.96	
Tender capacity : Water	6,000 Gallons	
Coal	10 Tons	
Maximum height of engine	13′—6″	(4,115 mm.)
,, width ,, ,,	9′—11″	(3,023 ,,)
Minimum radius of curve to pass	16°	(120 M.)

LIMITATION

Turn table, diameter	70′—0″	(21,336 mm.)
Limit of wreight :		
Front truck	10 Tons	(2,240 lbs.)
Driving wheel	16 ,,	(,,)
Trailing wheel	15½ ,,	(,,)

GENERAL DESIGN

The design of these locomotives are such that maximum number ot parts are to be interchangeable with those on the previous K.T.R. consolidation type locomotives.

Boiler and Boiler Fittings

Boiler.—Boiler type, inverted slope type, inside diameter of waist at front end, 65-in. (1,651 mm.), largest course, 72-in. (1,956 mm.) outside diameter, material of shell homogeneous boiler steel. Dome well secured to boiler, shell thoroughly reinforced at opening.

Boiler well designed thoroughly braced and stayed, of very best workmanship, and capable of carrying with a factor of safety of 4½, a working pressure of 200 lbs. per sq. inch (14.06 Kgs. per sq. cm.).

Boiler tested, with steam to 20 per cent and with hot water to 25 per cent above working pressure.

Sloping backhead and throat sheet.

Horizontal seams, butt jointed and multiple riveted with welt strips inside and outside.

Plates planed at edges and calked with round nose tool.

Rivet holes reamed, after assembling, to insure uniform holes and slightly countersunk under heads of rivets.

Rivets driven by hydraulic or pneumatic pressure wherever possible. 28-in. (710 mm.) combustion chamber.

Franklin Automatic Butterfly Type Firedoor applied.

Fire Box.—Fire box of homogeneous fire box steel. Length inside 96 1/16-in. (2,440 mm.). Width inside 65¼-in. (1,656 mm.), at grate surface.

Thickness ot crown and side ⅜-in. (9.5 mm.), tube sheet ⅛-in. (12.7 mm.), back ⅜-in. (9.5 mm.).

Water space front 4½-in. (114 mm.), sides and back 4-in. (102 mm.), combustion chamber 5½-in. (140 mm.).

Two fusible plugs on top of crown sheet.

Mud Ring.—Mud ring accurately fitted and substantially double riveted.

Staybolts.—Staybolts of staybolt steel 1-in. (25.4 mm.), diameter, screwed and riveted to sheets, spaced not over 4-in. (102 mm.) from center to center, and pneumatically driven. Telltail holes drilled to outer ends, about 3/16-in. (5 mm.) in diameter, 1¼-in. (32 mm.) deep. Crown sheet supported by radial stays of staybolt steel. Body 15/16-in. (24 mm.) diameter, with enlarged ends, screwed through the crown and shell and riveted over except six of center rows which have button heads under crown.

Suitable number of front transverse rows to be flexible expansion stays.

Alco. type flexible stays in breaking zone to be about 500 in number.

Superheater.—The Superheater Co.'s firetube type "A" with machine forged return bend. The superheater units to be of seamless steel, of 1½-in. (38 mm.) outside dia. No. 9 B.W.G. thick.

Tubes.—Tubes of seamless steel No. 12 B.W.G. (2.8 mm.) thick 139 in number, 2-in. (51 mm.) outside diameter 16-ft. 0-in. (4,877 mm.) long, set with copper ferules at fire box end, ¾-in. (19 mm.) tube spaces. 24 superheater flues of seamless steel 5⅜-in. (137 mm.) outside diameter, No. 9 B.W.G. (3.8 mm.) thick, 16-ft. 0-in. (4,877 mm.) long.

Fire Brick and Arch Tubes.—Fire brick arch supported on three seamless steel arch tubes, each of 3-in. (76 mm.) outside diameter, No. 7 B.W.G. thick.

Cleaning Holes.—Housley washout plugs, 4-2⅞-in. (73 mm.) diameter, on each corner of fire box, 20—2-in. (51 mm.) diameter distributed on sides and ends of fire box, above fire door and crown sheet,and for washing shell of boiler.

Blow-off Cocks.—Blow-off cocks, two everlasting, one located at each side of fire box.

Safety Valves.—Safety valves, three 3-in.(76 mm.) Consolidated type safety valve, one muffled and two open pops.

Water Supply.—Furnished by two Hancock No. 4000-HNL non-lifting inspirators, one located on each side of engine, below cab.

Hancock Double Vertical Check Valve on the top of boiler.

The steam and delivery pipes shall be of polished copper suction and over flow may be of iron.

Throttle and Steam Pipes.—American multiple throttle valve in smoke box, in combination with a superheater header, and cast iron outside steam pipes. A shut-off valve in the dome.

Grate.—Dump plates in front and rear are to be provided for in addition to cast iron rocking bars suitable for fuel.

Ash Pan.—Ash pan of steel plate, with sliding type doors. Sprinkling pipes at ash pan either from overflow or delivery pipe of inspirators.

Smoke Box.—Smoke box extended and fitted with netting, and deflecting plates.

Door of pressed steel, carefully fitted.

Smoke Stack.—Smoke stack, straight type with copper top, designed to give maximum draft. Top to have suitable flare.

Turret.—Turret located just on front of cab, and valve handles for operation to be brought inside of cab on a panel conveniently located and each handle clearly marked.

Gauge Cocks and Water Glass.— One Hancock water column with 8½ Klinger reflex glass and cocks.

Whistle.—One 5 chamber chime whistle to be applied.

Steam Gauge.—Ashcroft steam gauge, graduated in lbs. per sq. inch.

Frames, Cylinders, etc.

Frames.—Frames of cast steel, ample strength, thoroughly annealed. Single forward section provided with lugs for holding cylinders.

Frame thoroughly braced together and to boiler by suitable castings, braces, expansion plates and pads. Pedestals protected from wear by cast iron shoes and adjustable wedges and securely fastened together at bottom of pedestal.

Separate slabbed section at rear.

Cylinders.—Cylinder, diameter 21-in. (533 mm.), stroke 26-in. (660 mm.) of improved close grained cast iron as strong as can be worked. Cast with half saddle attached, secured together in a substantial manner and accurately bolted and keyed to frames.

Cylinder bushings of hard close grained cast iron.

By-pass valve Mellin type to be fitted.

Drain Cocks.—Four Automatic " Ardco " drain cocks applied.

Pistons.—Piston of build-up " Z " type, cast steel body with cast iron bull-ring, and fitted with cast iron packing rings.

Piston rods of best hammered steel, ample diameter, properly fitted and securely fastened to pistons and crossheads.

Valves.—Steam chest valves American Locomotive Co.'s standard piston type, having 11-in. (279 mm.) diameter.

Valve Motion.—Walschaert valve motion graduated to cut off equally at all points of stroke. Detail parts of soft steel with case-hardened wearing surfaces.

Reverse gear fitted with Alco type power reverse gear, right hand driven.

Rod Packings.—Metallic packing on piston rod and valve stems.

Guides.—Two bar type of steel, securely bolted to cylinder heads and to rigid guide yoke extending across frames.

Crosshead.—Crossheads alligator type of best cast steel with cast iron shoes babitted, ample bearing surfaces.

Driving Wheels, Rod, etc.

Driving Wheels.—Driving wheels, number 8, diameter 54-in. (1,372 mm.), with cast steel centers, diameter 47-in. (1,194 mm.), carefully proportioned and accurately counterbalanced.

Bronze hub liners in all drivers.

Tires.—Tires of open hearth steel (hard quality), 3½-in. (89 mm.) thick. All of flanged tires, 5½-in. (140 mm.) wide.

Tire profile and distance of wheel flanges to be exactly finished, as required.

Tire shrunk on center.

Axles.—Axles of hammered open-hearth steel, finished in best manner.

All journals, 9-in. (229 mm.) in diameter by 11-in. (279 mm.) long.

Boxes.—Boxes of cast steel, with deep flanges and large oil cellars, and carefully fitted with heavy bronze bearing arranged with suitable oil grooves.

Springs.—Driving springs of best open hearth steel, tempered in oil, and secured to a system of equalizing beams to insure the engine running as smoothly as possible.

Rods.—Connecting rods of hammeted open hearth steel, of I section, fitted with adjustable bronze bearing.

Side rod of hammered open hearth steel, with bronze bushings.

Crank Pins.—Crank pins of best hammered open hearth steel, with ample bearing surfaces.

Lubrication.—All bearings on engine provided with suitable means for their proper lubrication, adjustable oil cups on guides and suitable oil or grease cups on rods.

Cylinders and valves oiled from cab through ½-in. (13 mm.) copper pipes under jacket by lubricator. Nathan five feed bulls-eye lubricator applied.

Leading and Trailing Trucks

Leading Truck.—Frame of leading truck of best cast steel, carefully annealed. Truck boxes of cast iron with bronze bearings, boxes working in suitable pedestals with approved arrangement of equalizing beams and springs. Radial center bearing of ample diameter.

Springs.—Springs of best open hearth steel, tempered in oil.

Wheels and Axle.—Two steel tired wheels of 31½-in. (800 mm.) in diameter, with cast steel spoke centers.

Tires of open hearth steel 3-in. (76 mm.) thick by 5¼-in. (133 mm.) wide.

Axle of best hammered open hearth steel finished all over, with journals of 5½-in. (140 mm.) in diameter by 10-in. (254 mm.) long.

Trailing Truck.—2-wheel radial type with outside journals. Boxes of cast steel with bronze bearing, and face liners.

Wheels and Axle.—Trailing wheels of 42-in. (1,067 mm.) in diameter, with cast steel spoke centers.

Tires of open hearth steel 3-in. (76 mm.) thick by 5¼-in. (133 mm.) wide.

Axle of best hammered open hearth steel finished all over, with journals of 6-in. (152 mm.) in diameter by 14-in. (356 mm.) long.

Springs.—Spring of best open hearth steel, tempered in oil.

Cab, Pilot and Fixtures

Cab.—Cab substantially built of steel plate, thoroughly braced and secured to boiler and running board, furnished with suitable sliding windows and with convenient tool boxes, seats, cushions and arm rests for engineer and fireman. Right hand drive.

Running Boards.—Running boards of checkered steel plate. Edges to be polished.

Pilot.—Pilot of iron 92-in. (2,340 mm.) wide.

Engine Coupler.—Alliance Automatic or similar pattern, Pocket type, 42-in. (1,067 mm.) from center of coupler to top of rail, in working order.

Sand Box.—Sand box of ample capacity arranged with suitable valves and pipes. Leach Pneumatic Sander double.

Head Light.—One headlight, at front, Pyle-National " K-2 " type, turbo generator.

Fixtures.—Engine provided with support for headlight, bronze chime whistle, steam gauge, water gauge, gauge cocks, blowers, incandescent cab lamps, etc.

Steam Heat.—Gold steam heating equipment applied.

Bell.—Bronze bell with pneumatic ringer.

Tender

Frame.—Frame substantially built of steel channels thoroughly braced.

Coupler.—Alliance Automatic or similar pattern, 42-in. (1,067 mm.) from center of coupler to top of rail, tender 2/3 loaded.

Draft Gear.—Bradford rocker type or Edgewater type.

Trucks.—Two four-wheel center bearing trucks, arch bar type with heavy cast steel bolsters.

Springs.—Springs of best open hearth steel tempered in oil.

Wheels.—Wheels number 8, diameter 39½-in. (1,000 mm.) cast steel spoke center with 3-in. (76 mm.) thick 5¼-in. (133 mm.) wide.

Axles.—Axles of hammered steel, with journal of 5-in. (127 mm.) in diameter by 9-in. (229 mm.) long.

Brake.—Brake on both trucks with suitable brake beams.

Tank.—Tank water bottom type, made of steel plates strongly riveted together, with angle iron corners, thoroughly braced and stayed, and well secured to tender frame. Coal gates of steel.

Water capacity 6,000 gallons, Coal capacity 10 tons.

Tool Boxes.—Tool boxes of steel plate.

Brakes and Special Ties

Brakes.—Westinghouse American Combined Automatic and straight air brakes, Schedule ET No. 6, applied on all drivers, to tender wheels and for train connections front and rear. 12-in. brake cylinder.

Air Pump.—One 8½-in. (216 mm.) Cross compound air compressor on the left side of the boiler.

Lagging.—Boiler, cylinders, steam pipes, backhead and fire box under running boards lagged with sectional magnetia or asbestos mattresses.

All exposed pipes for steam and water to be lagged.

Jacket.—Boiler barrel, smoke box, cylinders, steam pipes, backhead and fire box under running boards jacketed with No. 16 B.W.G. thick steel sheets.

Tools.—Engine provided with all necessary wrenches, firing tools, hammers, chisels, packing tools, one pinch bar, one scoop shovel, oil cans and torch.

Necessary tools for tube, flue and arch tube workings.

Two traversing jacks.

General Finish

Cylinder Head Casing.—Cylinder head and steam chest head casings, front and back, pressed steel as polished.

Piping.—Piping to be carried underneath running boards and hidden from view as much as possible.

Templates.—All principal parts of engine to be fitted to gauges and templates so that they may be interchangeable.

Screw Threads.—All screw threads Whitworth standard except where finer threads are required.

Special fittings manufactured outside to have maker's standard threads, unless Whitworth threads also can be furnished.

Bolts and Nuts.—All finished removable nuts to be case-hardened.

Numbering.—All numbering and lettering to be attended to by the Railway.

Painting.—Engine and tender to be completely painted with two coats of lead color, two coats of black color, lined out with gold strips and finally varnished.

Testing.—Each locomotive to be fitted up and tested under its own steam before shipment.

Materials.—All materials to be manufactured according to the Chinese Government Railway Specification or builder's material specifications. Builder's workmanship and Inspection specifications to be applied.

Inspection.—The whole of the material and workmanship to be approved by the Inspecting Engineer appointed by the Ministry of Railways.

The Roots of China's Economic Depression

Unscientific Farming Methods Causing Shortage of Food Stuffs, Increasing Importations and Unfavorable Trade Balance

Rich in natural resources, abundance of man power, extent of arable land, rivers and streams available for irrigation purposes, China is the poorest country in the world from an economic standpoint.

The underlying cause of the poverty of China's agrarian population is the old-fashioned methods of farming. If she is to develop into a great industrial and commercial nation, it is absolutely essential that China adopt American and European ways of agricultural procedure. Superstition must be eradicated and faith in prayers for rain counteracted by the application of scientific principles.

A second cause of agricultural poverty is the devastation visited upon the provinces of Shantung, Chihli, Honan and Shansi. These are usually prosperous districts, but the continued presence of the military make these four provinces negligible as food producing areas.

A third cause is that of unscientific methods of farming, using man power instead of machinery to cultivate the ground. China needs highly trained agricultural experts and more agricultural colleges with extension courses for the farmers.

A fourth cause is the lack of sufficient railroads to distribute the over-supply from one section to a famine district, or for export.

A fifth, is the growing of the poppy on land that was once fertile wheat land, but is soon rendered unfit for other food products by the avid narcotic plant that sucks the land sterile of all plant food.

The sixth cause is found in the over-supply of population per square mile, this being greater in some districts than any other place in the world.

The total arable land in all China is estimated at about 737,312,938 mow, giving each person engaged in agriculture, (about 340,000,000 all told) an average of two mow each. Unreclaimed land can be developed to an extent that will increase the total arable land to about four billion mow. (One mow is considered about one-sixth of an English acre).

The poverty and living conditions of massed groups of people that swarm over these inadequate farms is appalling.

When considering the status of farmers in China, the amount of education possessed by these peasants enters into any valuation of their efforts as agriculturists. To keep in mind the higher level of education among farmers of countries with compulsory education such as America and France is to make the contrast all the more glaring.

Everywhere in China we find farmers living in squalid, miserable huts grouped in hamlets for defense against marauding bandits and licentious soldiery. The ground immediately contiguous to these hamlets is always under intensive cultivation, while grazing land at a little distance is pastured indiscriminatingly and unscientifically. The land-owners do little or no work themselves, being dependent upon ignorant, poverty-stricken tenants for the cultivation of the fields.

No machinery is used. The ploughing, sowing and harvesting is often done by man power alone, (and woman power), although some land-owners provide oxen and donkeys for a part of the work. The housing of the farmers is indicative of the lack of consideration these tenants receive and of the state of absolute penury in which they exist.

In several of the most thickly settled and most modernized provinces of China, about half the tenantry live in less than three rooms, although the family group may include from two to twelve persons. It is appalling to consider that millions of people are living in a condition of squalor and drudgery that soon reduces human beings to the mental standards of brute beasts.

Owners work farms in some provinces and tenants predominate in others. In Shantung the majority of farms are owner-worked, because the custom of dividing the land among the sons of the family has resulted in cutting the size of a farm to so small an area that the land cannot support an owner's and a tenant's families.

The amount earned from a mow of land and the income per farmer family makes impossible any improvement of conditions without a thorough revision of agricultural methods, whereby land can be made more productive and the scale of living raised for some 300 million people.

In a study covering the provinces of Chekiang, Kiangsu, Anhwei, Shantung and Chihli, the entire family income is derived as follows:—home industry, 3.8 per cent; Wages 17.0 per cent; Farm Products 68.3 per cent; Other sources 10.9 per cent. In general, we find land in China providing a subsistence for persons and animals per square mile about a hundred times as large as that of the United States. One square mile of arable land in China, not including mountainous country, supports 1,783 people, 212 cattle or donkeys and 399 swine, or 1,995 food consuming beings. In contrast, we find that in the United States, one square mile supports 61 persons and 30 horses or mules. The amount of food produced per acre is larger in China than in the United States but not 100 times larger. For instance, where America produces an average of 15 bushels of wheat to an acre, intensive farming and night soil fertilization in China brings in an average crop production of 25 bushels of wheat or rice per acre.

It is small wonder that we find 50 to 60 per cent of the entire population in the south of China living on less than $150 per annum while in the north of China we find over 80 per cent living on an income smaller than $150 per year. It has been computed that $150 represents the minimum allowance for food, and when there is the necessity of buying clothes, fuel, light and housing, the tenantry must skimp on food, which is just what happens. In northern China, the farmers hibernate during the winter months, subsisting on less food than one would think possible, and in the spring they emerge so emaciated and weakened that for weeks they are unfit for agragrian labor. The menus of the meals eaten by these peasants contain no meat, no eggs and no fish, the caloric value of their food being just sufficient to sustain life. These farmers live too near the margin of existence to have any thought save for the next meal. As citizens they are negligible and are a source of economic disaster to China, not only as stupid, credulous members of society, but as breeders of prolific families which only increases the problem of over-population.

The products raised on farms in China are used mainly in home consumption though certain commodities are cultivated for export. The list of exports with a valuation reaching into millions of dollars gives a ray of hope for further development of arable land and the introduction of mass production methods in agriculture to supply the demand for these products abroad.

Beans...	$213,698,708	Hk. Tls.
Raw Silk	160,789,890	,,
Skins-Hides	52,474,608	,,
Eggs-products	43,779,041	,,
Tea	37,133,853	,,
Cereals	36,717,280	,,
Raw cotton	34,158,765	,,
Silk piece goods	23,903,778	,,
Seeds-cake	829,129	,,
Cotton yarn-seed	21,590,039	,,
Groundnuts	16,594,524	,,
Cotton goods	16,357,762	,,
Bristles	10,072,422	,,

That the food problem is steadily becoming more and more serious in shown by the frequent occurrences of famine and the constantly increasing importation of foodstuffs from foreign countries. Although, economists such as Dr. Sun Yat-sen issued warnings six years ago regarding the growing shortage of food, the situation not only remains serious but tends toward an ever-growing danger point. We find that in 1928, China imported the following foodstuffs from outside sources:—

Sugar	98,697,923	Hk. Tls.
Rice	65,039,232	,,
Flour	32,801,936	,,
Cereals, seeds, spices, vegetables and medicines	29,830,464	,,
Fishery and sea products	26,125.843	,,
Animal products, canned goods, and groceries	17,343,111	,,
Total	269,838,509	Hk. Tls.

Thus we see that China imported about $400,000,000 of food materials, averaging about one dollar per head. The situation has become still worse, for up to July 1930, Hk. Tls. 100,000,000 of rice have been imported. Considering only the masses of people who consume the bare necessities for existence, we could exclude those items except rice, flour and cereals from the list, as only the rich people use the more costly articles. But for the past year a terrible famine has raged and there are millions of people who cannot even obtain the necessary amount of food for subsistence. Consequently the true shortage of food is greater than even the importation figures would indicate.

Usually drought occurs in China every five years. The provinces most dangerously affected have been Hopei, Honan, Shantung, Shansi and Shensi. In 1920-1921, there occurred in North China one such drought, which affected 20,000,000 people, a fourth of whom died from starvation. Figuring from the basis that each family of five (a conservative estimate) needs $100 worth of food a year, the damage of food materials amounts to $400,000,000. This makes an average of approximately $100,000,000, loss each year.

Floods are another cause of famine in China. The Hwai River floods large areas of land in Anhwei and Kiangsu every six or seven years and causes an annual damage of food equivalent of 25,000,000 piculs of rice. Hopei province is also afflicted with recurring floods. The narrow Hai Ho is inadequate for the discharge of large volumes of water in that province. The annual loss is probably $20,000,000. The Yellow River, which does not do so much damage now as formerly, is still a potential enemy of the peasantry dwelling in it's vicinity, the loss per annum being close to $20,000,000. In 1925, it broke through a dike in Shantung, flooded 800 square miles of land and damaged $20,000,000 worth of farm products. The total yearly damage from floods in China can be estimated as close to $200,000,000.

In addition to floods and droughts there are other causes that influence the food supply, such as insect pests in great numbers. Then there are wars, banditry, communistic disturbances and marauding, unpaid soldiery that cause the farmers to leave the fields uncultivated. This loss is difficult to estimate, but in general it is safe to say that it amonuts to about $100,000,000 per annum.

All these factors combined show a yearly loss of about $400,000,000, which results in widespread famine areas. First, there are the farmers to be considered, who must live off their old stock of food supplies or succumb to starvation. Assuming that 10,000,000 people are directly affected by famine and that one needs $20 for food, we arrive at the result that the shortage of food is $200,000,000, so far as the famine regions are concerned.

This is one of the factors that raises China's unfavorable balance of trade to Hk. Tls. 204,614,283, per year. When it is realized that 95 per cent of China's export trade is concerned with agricultural products, the liquidation of the unfavorable balance looks remote, unless American and European methods are adopted. To plow and sow one acre of land with wheat by manual labor requires 27 man-hours; but with machinery only one man-hour is required. Also, waste and meagre crops can be changed to efficient methods of production with increased yields.

The wheat situation is affected by the demand for Canadian and American wheat and flour, which is imported in great amounts, while China's wheat of poorer quality is exported:

EXPORTS:

1925	...Piculs	157,285—	Hk.Tls.	713,963
1924	...Piculs	288,000—	Hk.Tls.	303,191

IMPORTS:

	Wheat-1925		*Flour-1925*	
American and Hawaii	Piculs	111,194	Piculs	931,524
	Hk.Tls.	422,851	Hk.Tls.	5,088,496
Canadian ...	...Piculs	640,080	Piculs	272,056
	Hk.Tls.	2,455,803	Hk.Tls.	1,488,410

Although China produces annually about 30,060,000 to 40,000,000 tons of rice, the amount is inadequate for the needs of the people and large quantities are imported. There is much arable land that could be reclaimed and used for rice growing thus creating a supply equal to the demand of the home market. In 1924, China imported Hk. Tls. 63,248,720 of rice from Saigon and Hongkong. Some rice is also shipped from Siam and British India, usually consumed in the southern cities of China. Every effort will have to be made in the near future to supply Chinese people with this staple food from native soil, thus liquidating a part of the present unfavorable balance of trade.

Silk not only is the outstanding crop in China, but ranks first in it's excellent adaptation to the climatic and soil conditions of the country. Millions of cocoons in a raw state are sent to foreign countries to be cared for and the silk manufactured when the period of hibernation is over. Most of the silk cocoons come from the Central China region.

Sericulture is being studied more seriously in China than in any other country at present. Because of the cramped living quarters of the tenant farmers, the silkworms are often reared in a room which is also the sleeping and living room of the family, and therefore, even if the worms are reared from healthy eggs they are apt to deteriorate and become diseased on account of the foul air. Application of scientific methods would improve the quality of the cocoons and increase their production without necessarily extending the area now cultivated for mulberry plants.

The recent crop of cocoons in Japan was increased some 12 to 20 per cent by a new method, which consisted in disinfecting the trays and keeping the worms healthy by sprinkling powdered lime.

In regard to the export trade in the past, with some exception the growth has been steady. During the decimal period ending 1913, exports averaged annually 41.4 per cent of the total trade of China while in the decennial period ending 1923, the exports averaged 44.3 per cent. Between 1896 and 1913, the period of China's large development and expansion in foreign indebtedness, the exports increased faster than did the imports. Then, comparing 1923, with an average for the years 1894, 1895 and 1896, which for imports was 178,700,000 taels and for exports was 134,100,000 taels, the year 1923, showed exports as 560 per cent of 1894-6 but imports only 510 per cent of the amounts in those years.

During the inclusive years 1915-1919, the surplus of imports over exports fell below 100 million Hk. Tls. to as low as 16,188,270 in 1919. This was because the imports fell off and the World War stimulated exportation of food and other supplies to Europe. The height of the peak was reached in 1919. Although immediately following the World War, imports grew rapidly and exports decreased at a corresponding speed, it will be noted in 1923, that China's exports increased by 100,000,000 taels over 1922, while imports declined about 22,000,0000 Hk. Tls.

The only salvation for China is to increase her exports by expanding her agricultural resources. The principal item of export from China is silk. In 1923, silk made up 23 per cent of the total exports. The total amount exported including silk goods was worth 170,000,000 Hk. Tls. The product of the silkworm and the mulberry tree has contributed much to the economic welfare of China, and is now the largest factor determining China's buying power abroad. In 1860, half the world's supply of raw silk was furnished by China. In 1880 and in 1900, 40 per cent in China's exports were of silk. In 1918, it was only 22 per cent and in 1923 it was 23 per cent. This was all in the form of raw silk except for 3 per cent. The increase in the sale of raw and wild silk and silk waste has been as follows:—

Year	*Weight-1000's piculs.*	*Value-Millions of Hk. Tls.*
1919	345.6	113.9
1920	229.7	76.9
1921	275.7	121.2
1922	306.5	148.4
1923	344.4	154.3
1924	382.2	122.4
1925	401.5	133.0

In the period from 1910, China secured only about 30 per cent of the world's raw silk trade, Japan increasing in that period from 38 per cent to 51 per cent. One reason why China's dominant place in the foreign silk marts was taken by Japan, France and Italy was in part because of the modern methods employed by these countries, while China continued to use the obsolete methods of centuries ago.

Some definite plans are afoot to improve the process of sericulture, new training and experiment stations being opened up in the leading producing centers ; afforestation of waste lands with scrub oak for feeding purposes ; the organization of the selling of the cocoons ; the increasing establishment, and operation of silk filatures using modern machinery ; greater attention to preparing the raw silk suited to the speed of the foreign high speed looms ; and the development of factories for the manufacturing of silk products. The application of modern methods of sericulture and manufacture should double the quantity of silk and silk goods that are exported in a few years.

Another of the important products of China is the soya bean and bean products. The area planted to beans is small compared to the potential development of this industry. This will be one of the crops that will do much to lift the peasant and his impoverished family from the slough of poverty and ignorance. The following figures will give some idea of the present crop export and the destination of a great portion sent out.

	1924	*1925*
Japan	7,000,000 piculs	6,500,000 Hk. Tls.
Europe	3,400,000 „	2,600,000 „
Java	1,200,000 „	1,200,000 „

Beans, beancake, and bean oil constitute 15 per cent of the exports for the year 1923, while in 1910 there were only 8 per cent, giving an increase in the annual value of the export of these commodities of over 100,000,000 Hk. Tls., in thirteen years.

In addition to the Soya Bean oil, China produces other vegetable oils which have become important articles of commerce. In 1910, vegetable oils were 3¼ per cent of total exports, in point of value, while in 1923, vegetable oils, exclusive of bean oil, constituted over 5 per cent of the exports. Among vegetable oils are included peanut oil, tea oil and wood oil. Exports of all these oils, including the ubiquitous bean oils, have increased materially in the last twenty years :

Average 1898-1902	330.2 thousands of piculs.
1913	1,212.0 „ „ „
1923	3,443.9 „ „ „

Some idea of the importance of China's cotton industry can be seen when we compare China with other nations of the world. We find that the nations rank in importance in commercial cotton production as follows : United States, India, Egypt and China. In 1916, China ranked third, and since 1921 new figures show that it now outranks Egypt. It is extremely difficult to find an accurate and precise estimate of the cotton crop in China, due to the fact that it is grown over a wide area, on small farms, widely scattered, and it is often planted along with other crops. The Chinese Ministry of Agriculture and Commerce has estimated the area at 26,000,000 mow.

One reason why the obtaining of cotton production figures is so difficult is due to the common practice of Chinese farmers of retaining relatively large quantities of cotton for padding their winter garments, bedding, etc. and for home spinning when cotton prices give a low return for their labor. One reason why China exports large quantities of her short staple cotton of kinky fibre for use in the making of blankets and heavy goods is that she has an over supply of this article and is badly in need of the long, silky staple from India or America.

Recently, Chinese farmers have been planting American seed and are successfully producing a long staple cotton, which with further development will eventually make any importation of cotton into China totally unnecessary.

Most of the tea raised in China is produced in the southern Provinces. The Ministry of Agriculture and Commerce estimates the total yearly output of tea for market use to be over two million cases of a value of 40 million dollars. In 1820, tea made up 75 per cent of the exports of China, and for the following fifty years China almost supplied the world with tea. In 1923, however, tea represented only three per cent of China's exports.

The actual figures as taken by weights throughout the years show a decline in amounts of tea actually exported as well as in comparison with other commercial articles.

TEA EXPORTS TO FOREIGN COUNTRIES

	piculs.		*piculs.*
1913	1,442,109	1920	305,906
1914	1,495,799	1921	430,328
1915	1,782,353	1922	576,073
1916	1,542,633	1923	801,417
1917	1,125,535	1924	765,935
1918	404,217	1925	833,008
1919	690,155		

When viewed from the standpoint of values, tea exports in 1913 were 25,278,000 Hk. Tls. and in 1922, 16,622,000 Hk. Tls.

India and Japan have given China much competition in the tea trade and without much effort, due to the high cost of production in China because of the inland tax on tea as well as the export duty. Then, too, methods of cultivation and marketing are very important and the Indian teas were produced on a large scale and were carefully advertised and marketed. However, there are great possibilities for expansion in this trade, as tea has world markets to consider. The resumption of commercial relations with Russia will take much of China's product. Brick tea, is largely sold in Russia and Siberia. Also since 1919 the export duty has been remitted in whole or in part, and this policy will probably be continued.

We have not yet encompassed all the agricultural possibilities of this ancient land ; yet this cultivation of the earth is the very foundation of civilization. In the West the soil is new and there is much acreage per person, and we have only just begun to maintain fertility of the soil. This problem the Orientals have solved in their own way, and though we may not adopt similar methods, yet we can profit by their age-old experience.

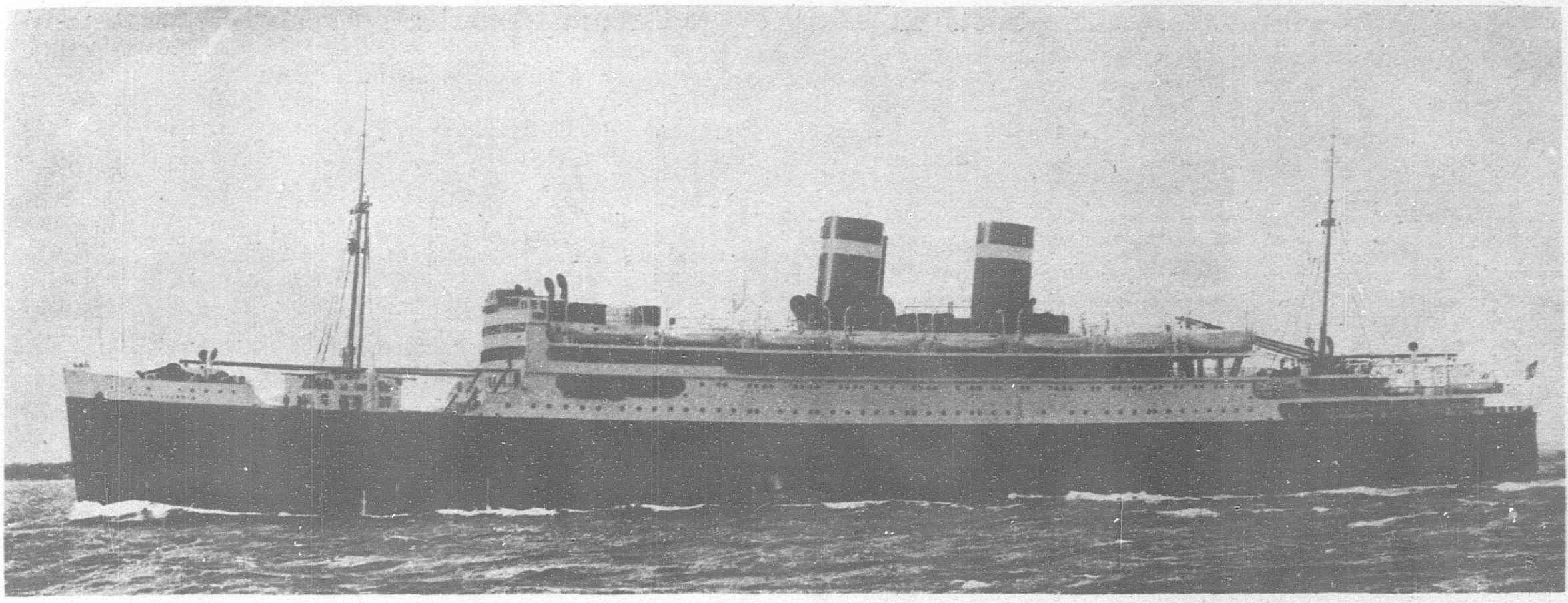
In thinking of the momentous industry of agriculture we must take into consideration some of the practices of a virile race of some 400,000,000 people who have an unimpaired inheritance moving onward with a momentum acquired through 4,000 years ; we find a race of people morally and intellectually strong, mechanically adept, who are awakening to the potential possibilities which science and invention have brought recently to the western nations.

Time is a function of every life-process as it is of every physical, chemical and mental reaction. The husbandman is an industrial biologist and as such compelled to shape his operations so as to conform with the time requirements of his crops. They have adopted a multiform succession of crops which has made possible the maintainence of a vast population for 40 centuries.

Some of the immediate plans for the increased production of agricultural products might well be mentioned that the present economic status of agriculture be improved. China has need of western trained experts who will have charge of experiment stations in every " hsien " district. The means of securing these scientifically trained young men might be inaugurated under the Boxer Indemnity funds. The plan suggests sending 30 experienced workers per year for 10 years to Western countries, each student would study for three years with an allowance of $3,000 per year. This would eventually supply skilled experts to direct the reorganization work in China.

Transportation facilities will have to be augmented so that an oversupply of food from one region might be transferred to a famine region ; the growth of the opium poppy should be prohibited except for a small amount necessary for medicinal and scientific purposes ; birth control doctrine and appliances will have to be taught to reduce the present over population per square mile ; the adoption of western trained experts will result in farming on a large scale similar to the mass production methods of manufacturing which is necessary if China is to produce enough agricultural products for export to liquidate the present unfavorable balance of trade ; the cessation of internal warfare is, of course, necessary before any program can be efficiently promulgated.

However, considering the vast area of China, the innate industriousness of her people, the eager markets of the world needing her products, the future looks on the whole, very bright for the potential development of a prosperous and scientifically trained nation, which will be the dominant factor in the markets of the world.—ROSE LEBBRAND.



Newest Turbo-Electric Liner "Pennsylvania," 33,375 Tons, 613 Feet in Length

Traveling Around America

Great Turbo-Electric Liners of Panama Pacific Line Offer Wonder Voyage Through Panama Canal

Of great interest to people living in the Orient expecting to return to America, England and Europe *via* Trans-Pacific routing and proceeding from San Diego, Los Angeles, or San Francisco to New York *via* the Panama Canal is the availability of the three monster, electric liners of the Panama Pacific Line, the S.S.'s *California*, *Virginia*, and *Pennsylvania*, the last word in ship design, which stand at the head of a new and greater merchant marine.

In laying out its program for the service from California to New York *via* the Panama Canal and Havana the Roosevelt International Mercantile Marine Company, owners of these ocean greyhounds, insisted that their vessels must be of the highest standard to be found in the shipyards of the world.

These vessels, brought into being by the Panama Canal, have been in service since 1928 when the *California* was launched as the largest American-built liner and the world's largest commercial vessel with electric propulsion.

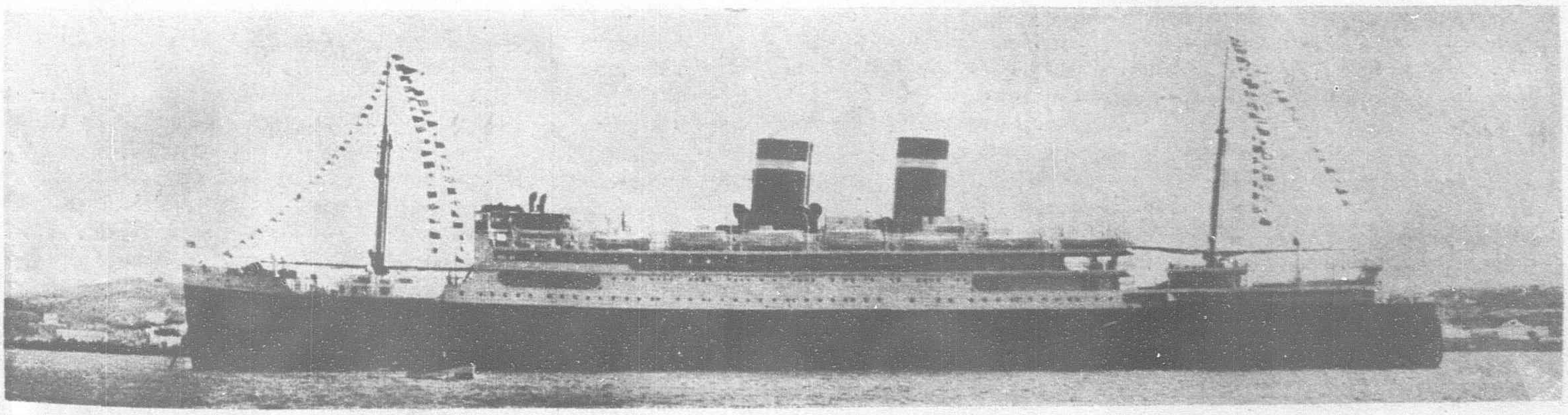
In 1915, the first year the Canal was open to travel, the Panama Pacific line instituted a New York-California service with their older trans-Atlantic Liners, the *Kroonland* and *Finland*. The war interrupted the service, but two other ships of the trans-Atlantic type were assigned to replace the *Kroonland* and *Finland* and this service has prospered until the order went out for the construction of the three largest and finest liners to fly the American Flag.

These vessels are unique among the vessels engaged specifically in inter-coastal trade since they are the only vessels of trans-Atlantic type to be built specially for service through the Panama Canal. It was necessary to modify the original plans of the vessels as a matter of course in order that they might specially meet the requirements of voyages that are largely through sub-tropical waters but they have retained in their construction and equipment all the requirements of modern trans-Atlantic ocean liners.

These vessels are 601-ft. in length, 80-ft. beam and from upper deck to keel are 100-ft. high. They carry 8,000 tons freight and 750 first and tourist class passengers, making the run from New York to California in the fastest time of any of the berth vessels.

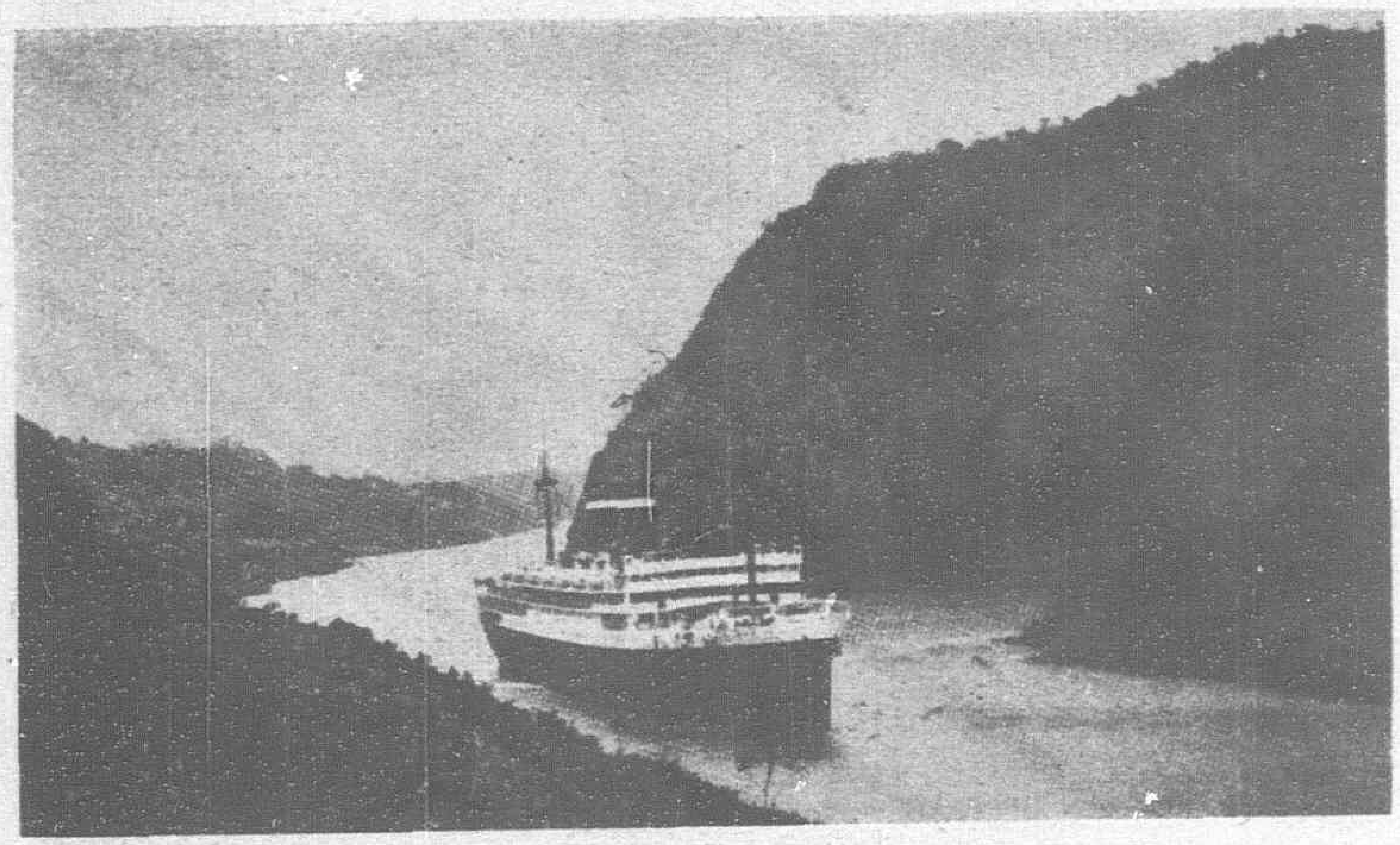
The mechanical departments of the *California*, *Virginia* and *Pennsylvania* offer complete novelties for they have no engines in the ordinary sense. Electric engines drive them through the water as created by small twin turbines that drive two generators at the rate of 2,880 revolutions a minute. The energy thus created is transmitted by cables to two great motors directly attached to a shaft on the outer end of which are propellers 18-ft. in diameter and weighing 39,000 lbs. The motors look like exaggerated radio microphones, being great, round, steel shells standing 16-ft. high. Oil fired boilers generate steam to actuate the up-to-the-minute power plant, and oil for the round voyage is carried in tanks in and near the vessels' double bottom. Electricity is employed throughout the ships and justifies the title of the electric liners.

Even as ships are rated in these days of giant liners, the electric trio are large vessels, and because they were the first commercial vessels to employ turbo-electric propulsion they have attracted

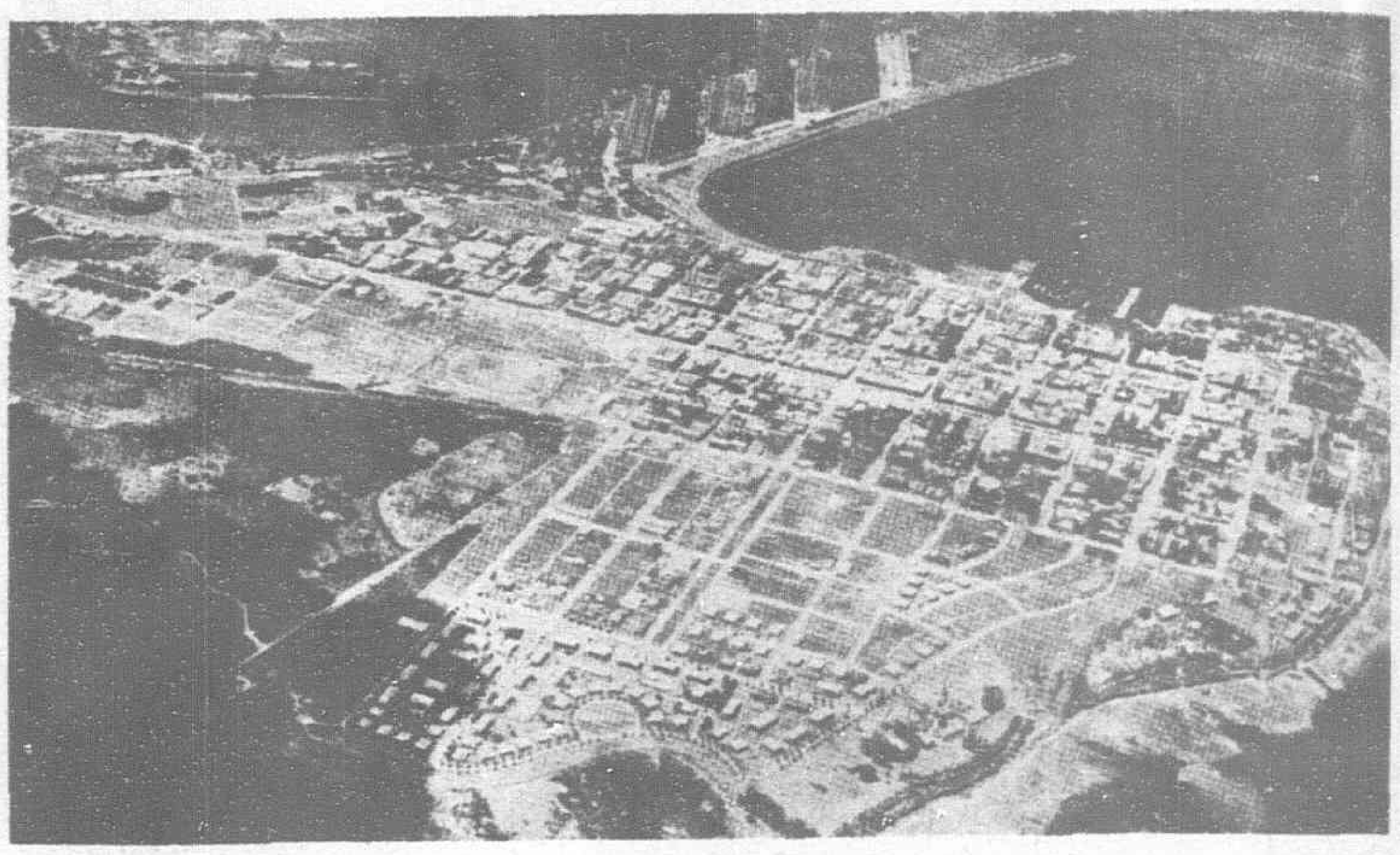


The "California" shown above shares with her Sister Ships, "Virginia" and "Pennsylvania," the Proud Record of Standing at the Head of the American Merchant Marine

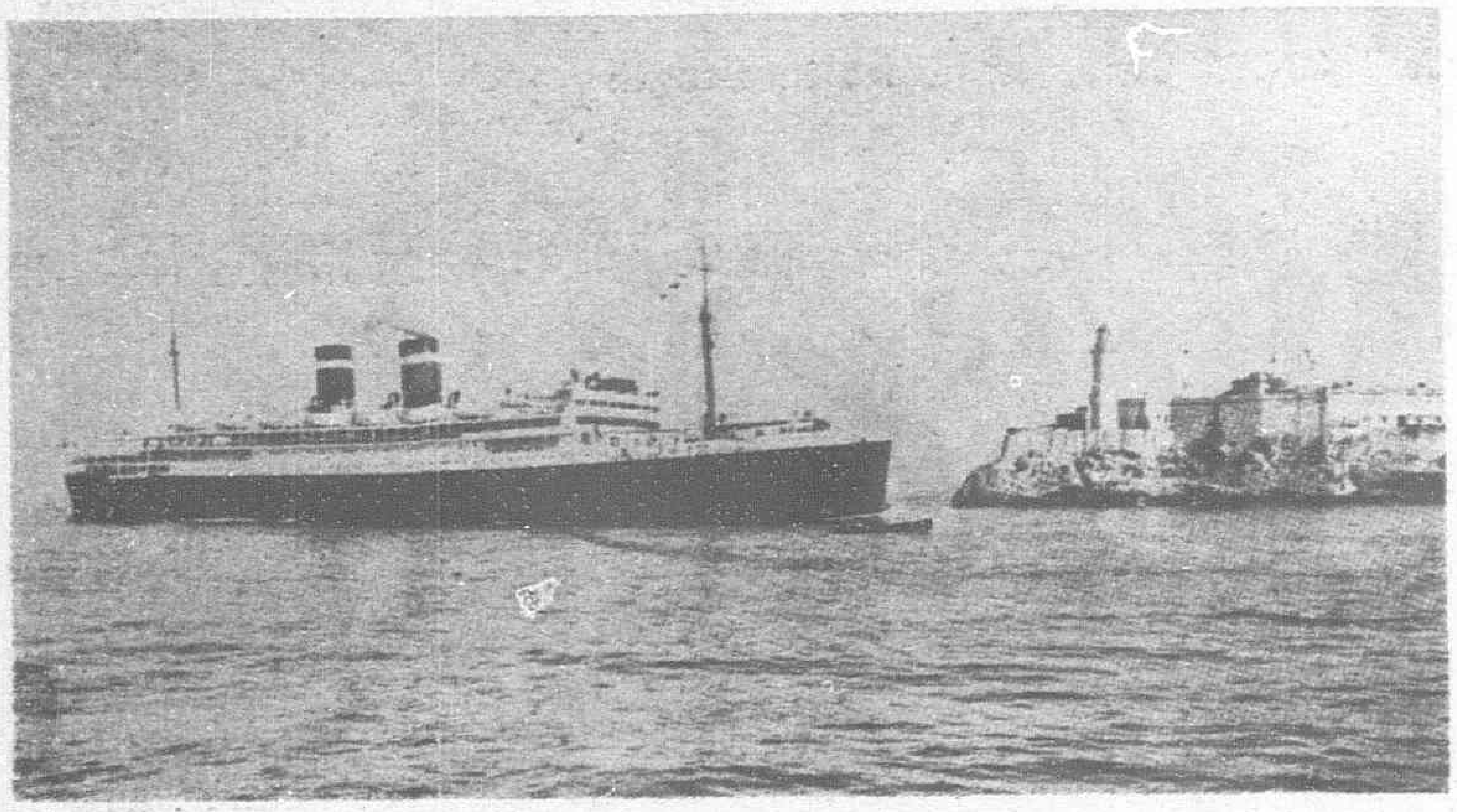
Historic Spots on The Voyage Around America



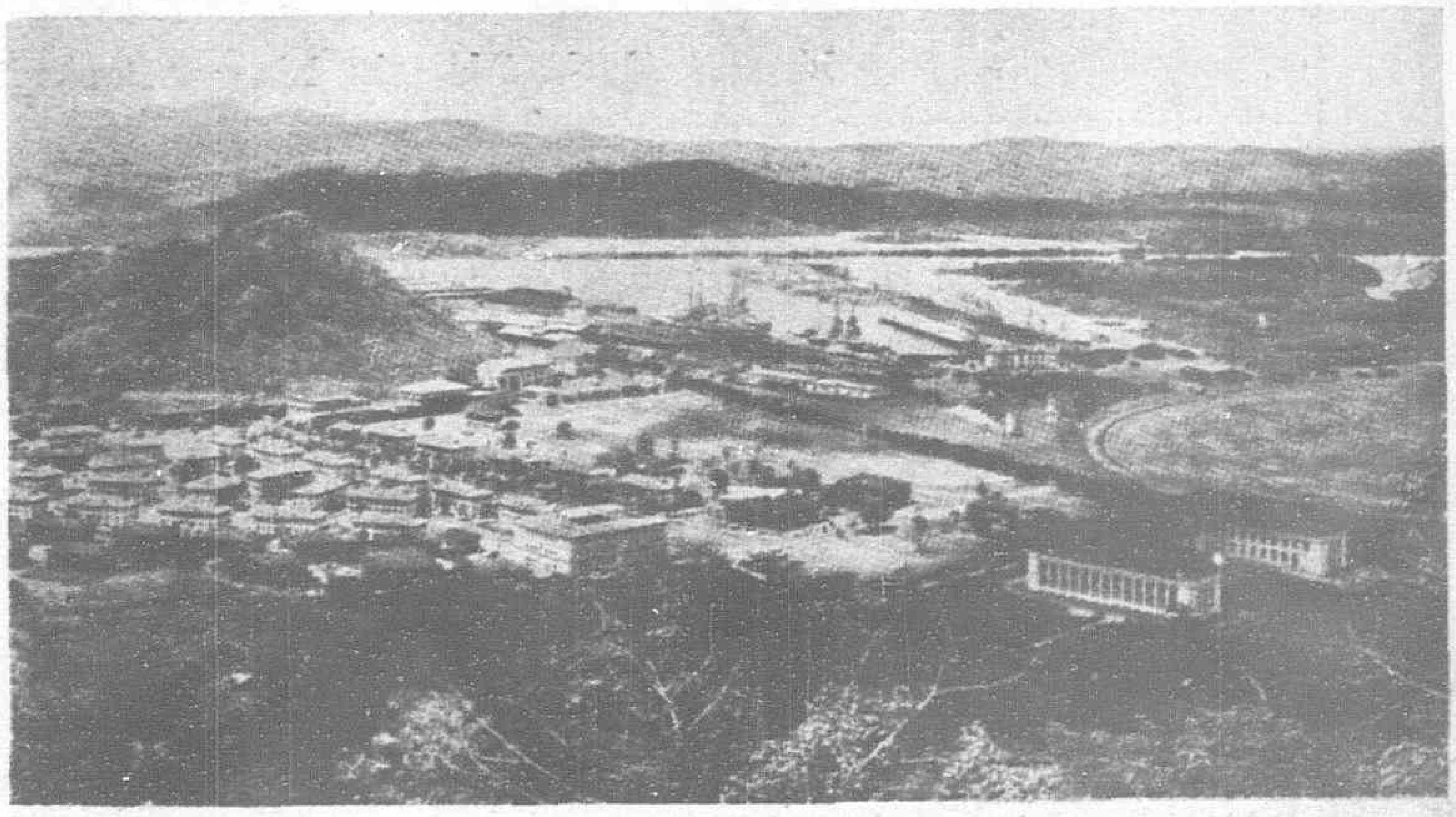
Panama Pacific Liner passing through Gaillard Cut, Panama Canal



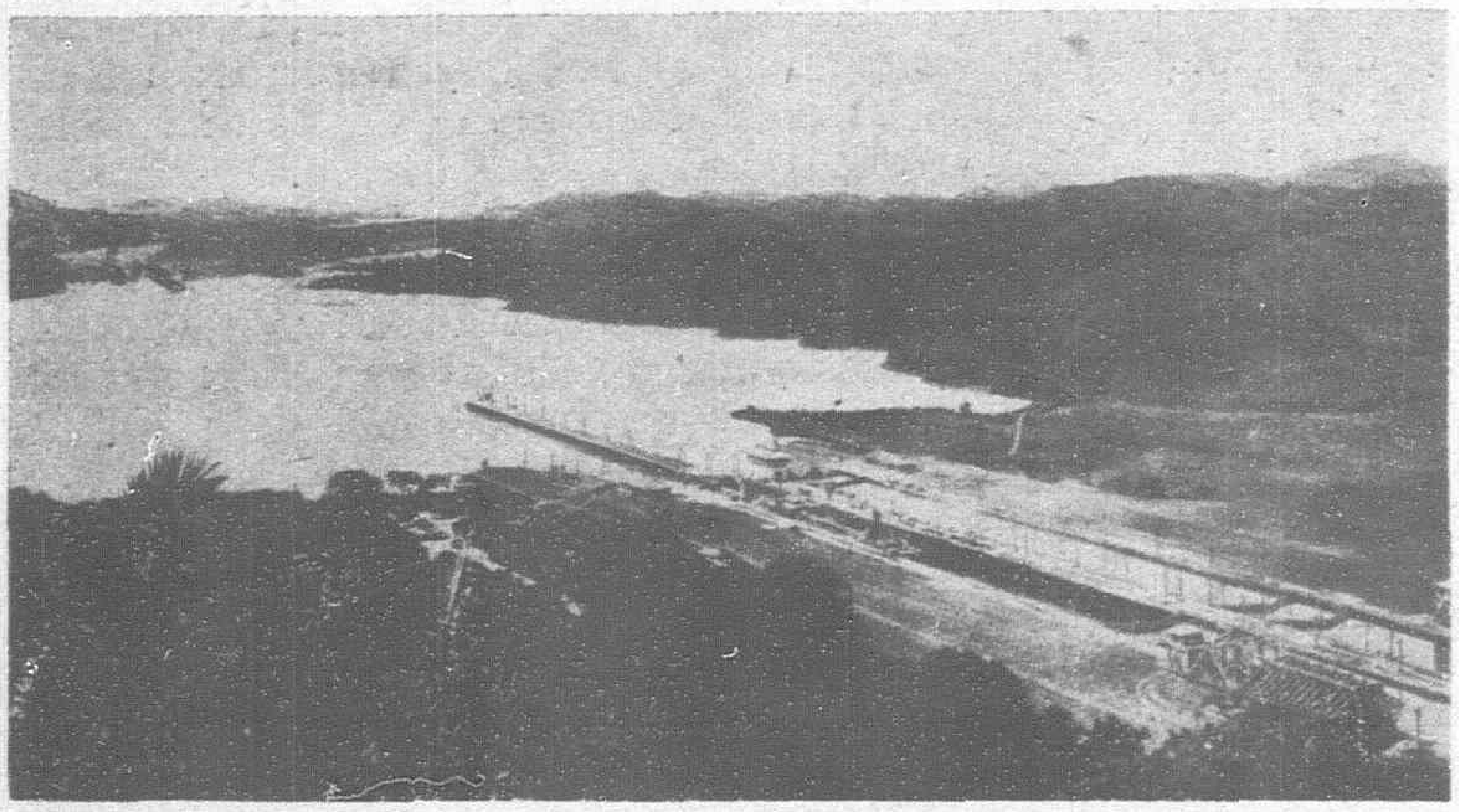
An Air view of Picturesque Colon at Atlantic End of Panama Canal



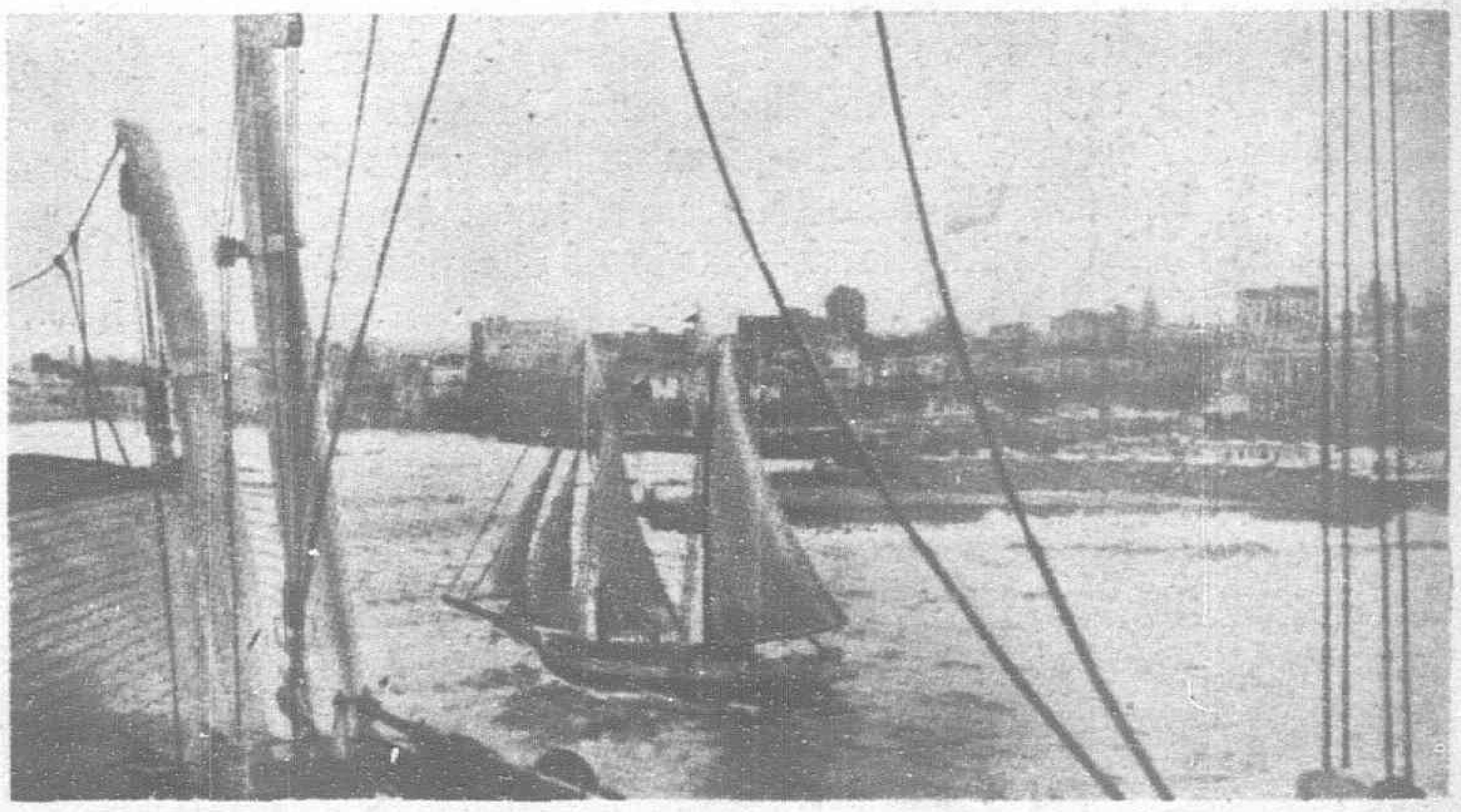
Passing Morro Castle—Arrival at Havana



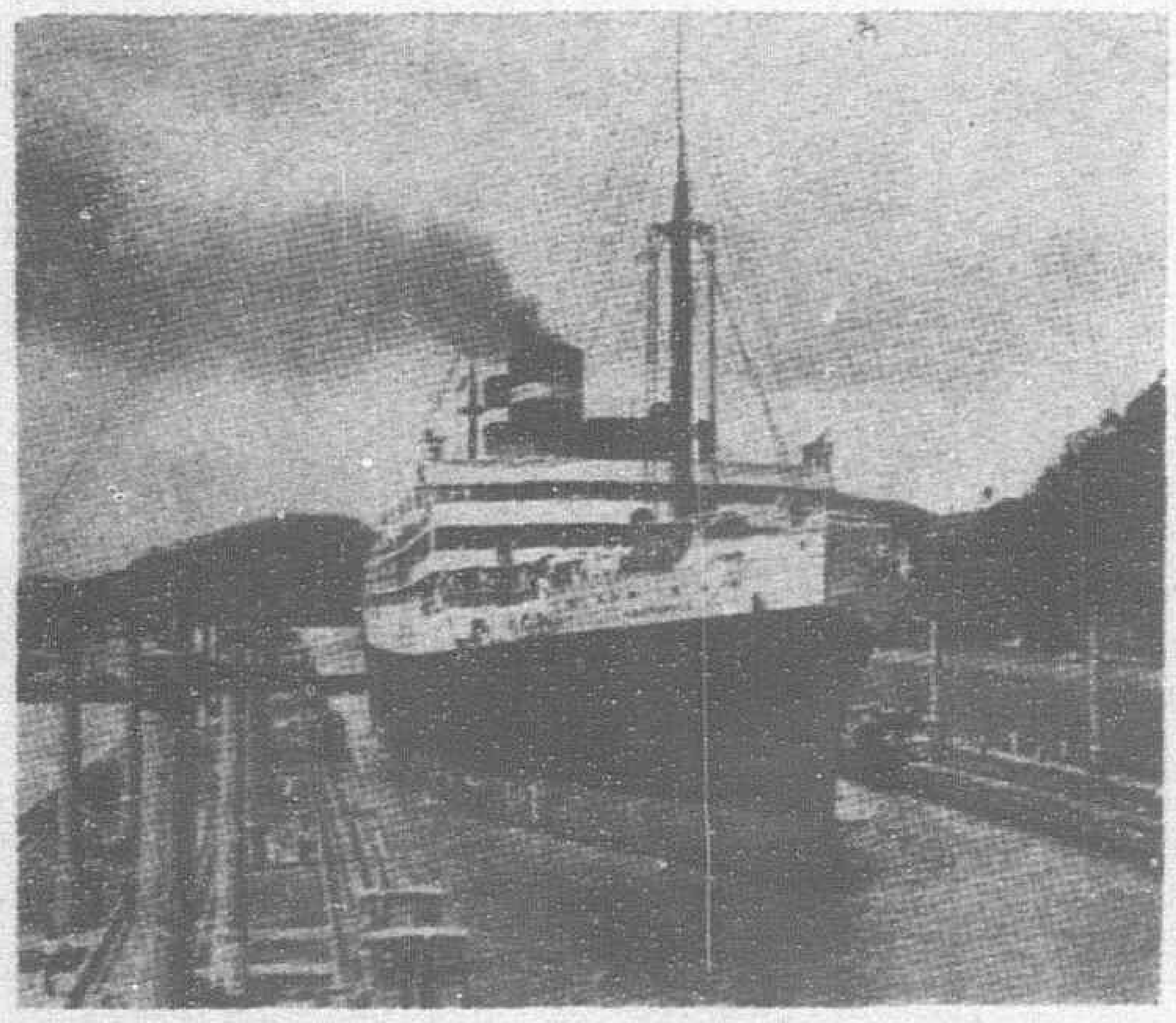
Balboa, Model American Port at Panama Canal's Pacific End



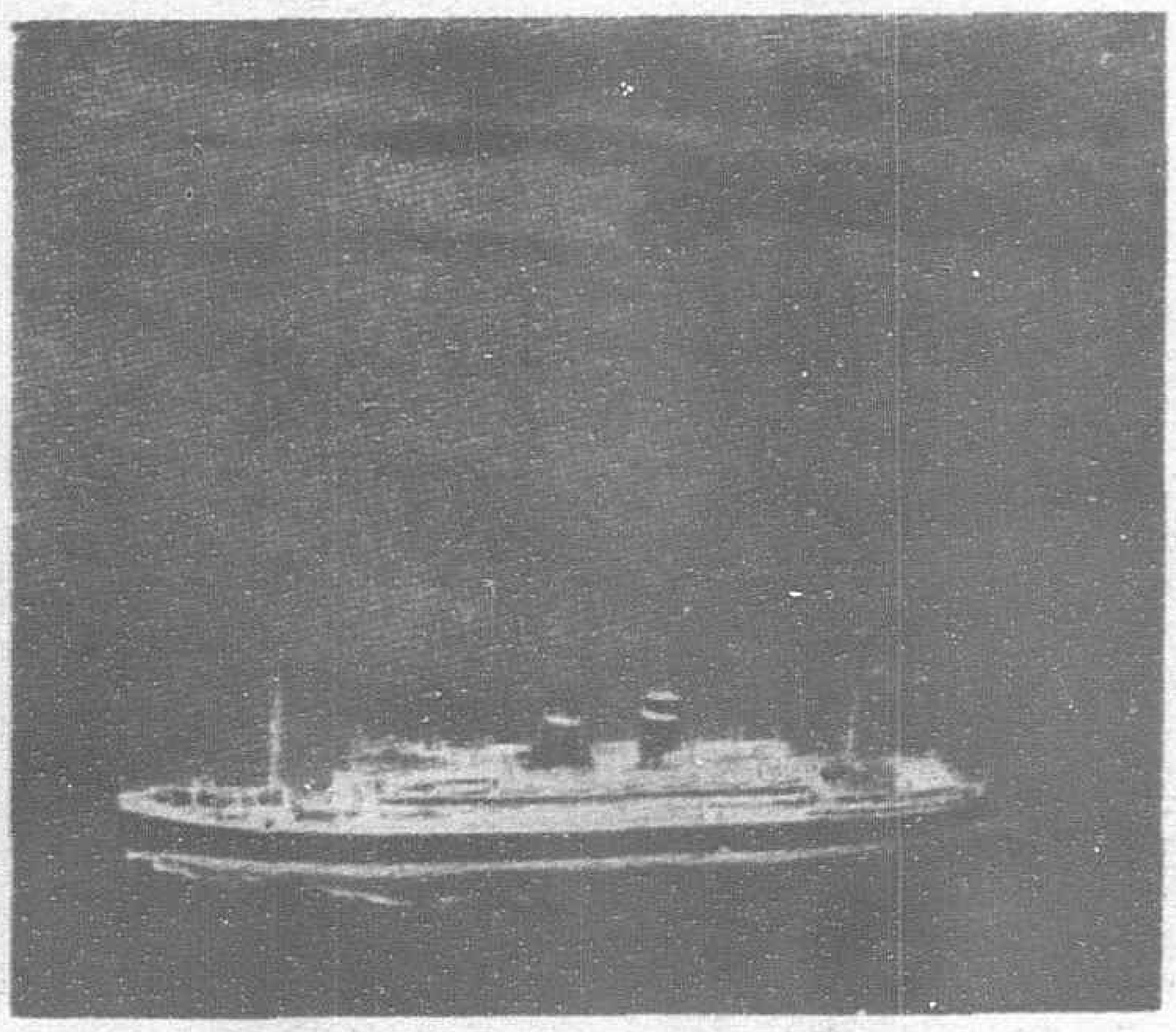
Pacific Locks, Panama Canal Looking Across Miraflores Lake to Gulf of Panama



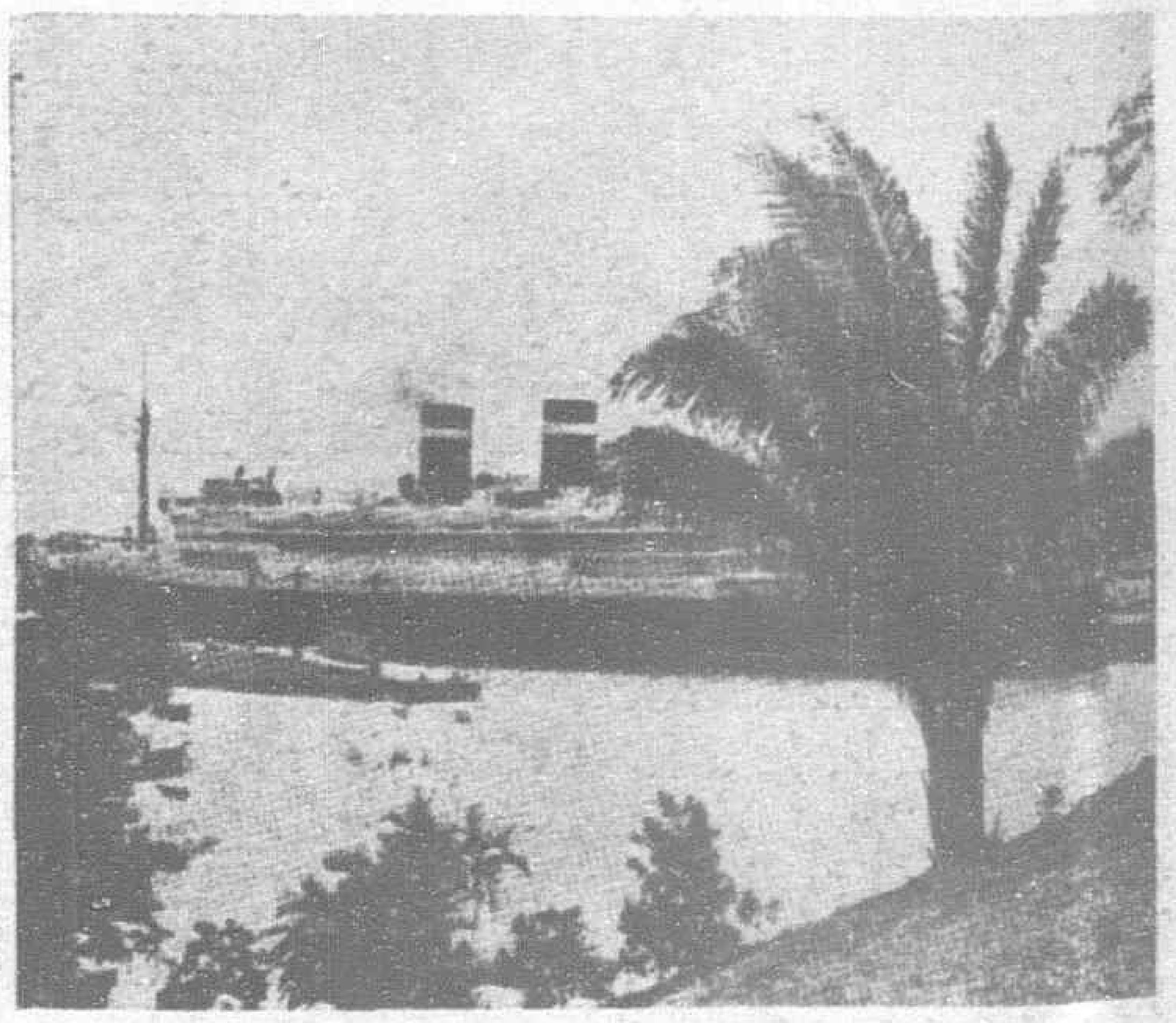
Havana's Breezy Foreshore where the Bright Sea Dashes against Grey Old Fortress Walls



Panama Pacific Liner in Pedro Miguel Locks



Crossing Gatun Lake



Panama Pacific Liner in Miraflores Locks world-wide attention, not only among ship owners, who have watched with keen interest the splendid performance of the *California* and *Virginia*, but from the public, which has been quick to appreciate the unique service they offer.

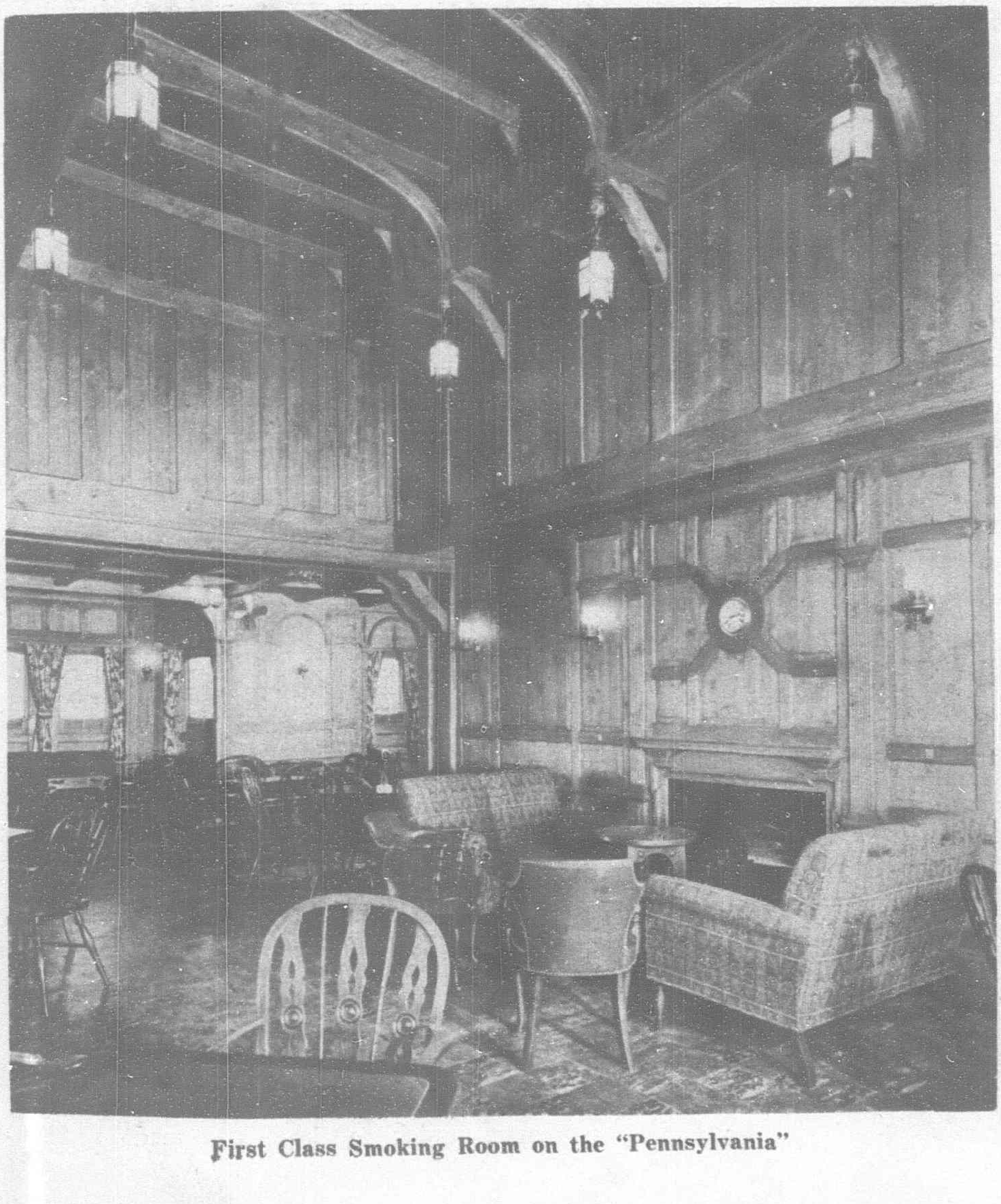
The inheritance of the *Pennsylvania* comes from a steamship line foremost in the annals of American shipping and her appearance upon the sea symbolizes an encouraging rejuvenation of the American merchant marine. She is named after the famous American liner *Pennsylvania*, flagship of the American Steamship Company of Philadelphia, a first-class flyer of her day, which made history for the American flag in the early seventies on the run between Philadelphia and Liverpool. It was sentiment that brought this pioneer line into being, and the spirit of national pride that actuated the little group of patriotic Philadelphians to build up a better fleet than its foreign competitors, has been foremost in the minds of the International Mercantile Marine Company's officials in the building of the second Pennsylvania.

First Class Lounge on the "Pennsylvania" showing Stage

The Pennsylvania's Machinery

In her mechanical equipment, the *Pennsylvania* like her sister ships, presents certain refinements based on experience which make her electric driving plant the finest of its kind. Her motive power, made by the General Electric Company, was designed for turbo-electric operation, including the operation of auxiliaries.

The three liners are of the twin screw design, each propeller being driven directly by an 8,500 horse-power motor. The electricity for driving these motors is generated by two marine type steam turbines, each rated 6,750 shaft horse-power (2,640 revolutions per minute) the latter corresponding to approximately 110 revolutions per minute, propeller speed. These turbines are each directly connected to an alternating current generator, rated 5,250 kilowatts, 2,640 revolutions per minute. Steam for driving the turbines is furnished by eight Babcock and Wilcox water-tube boilers, equipped with oil burners. The twin driving motors of 17,000 collective shaft horsepower, although coupled directly to the driving shafts, can be changed from full speed ahead to full speed astern, or the reverse, in 15 seconds. The vessel's fuel capacity is sufficient for a complete round trip of 11,000 miles between New York and San Francisco.



First Class Smoking Room on the "Pennsylvania"

Auxiliary and refrigerating machinery, deck winches, pumps, ventilating system, boat davits, elevators, freight lifts and kitchens are all electrically operated. The only fuel required is charcoal for the meat broilers.

The ship's rudder is controlled by means of hydro-electric steering gear consisting of four cylinders with two double plungers, located forward of the rudder stock, with pumping sets in duplicate and automatic follow-up mechanism. The gear is designed to stand the pressure incident to putting the rudder from hard-over to hard-over through an angle of 70 degrees in 30 seconds, when the ship is moving ahead at a speed of 18 knots.

The steering gear consists of two 75-horsepower, 400 r.p.m., 230-volt, compound wound, direct-current motors each driving a variable-stroke pump supplying fluid to steering gear plungers. Control of the plungers is located in the pilot house, and the motors can be started and stopped either from the engine room or from the steering motor room. General Electric type magnetic contactor, non-reversing control equipment is used with the motors.

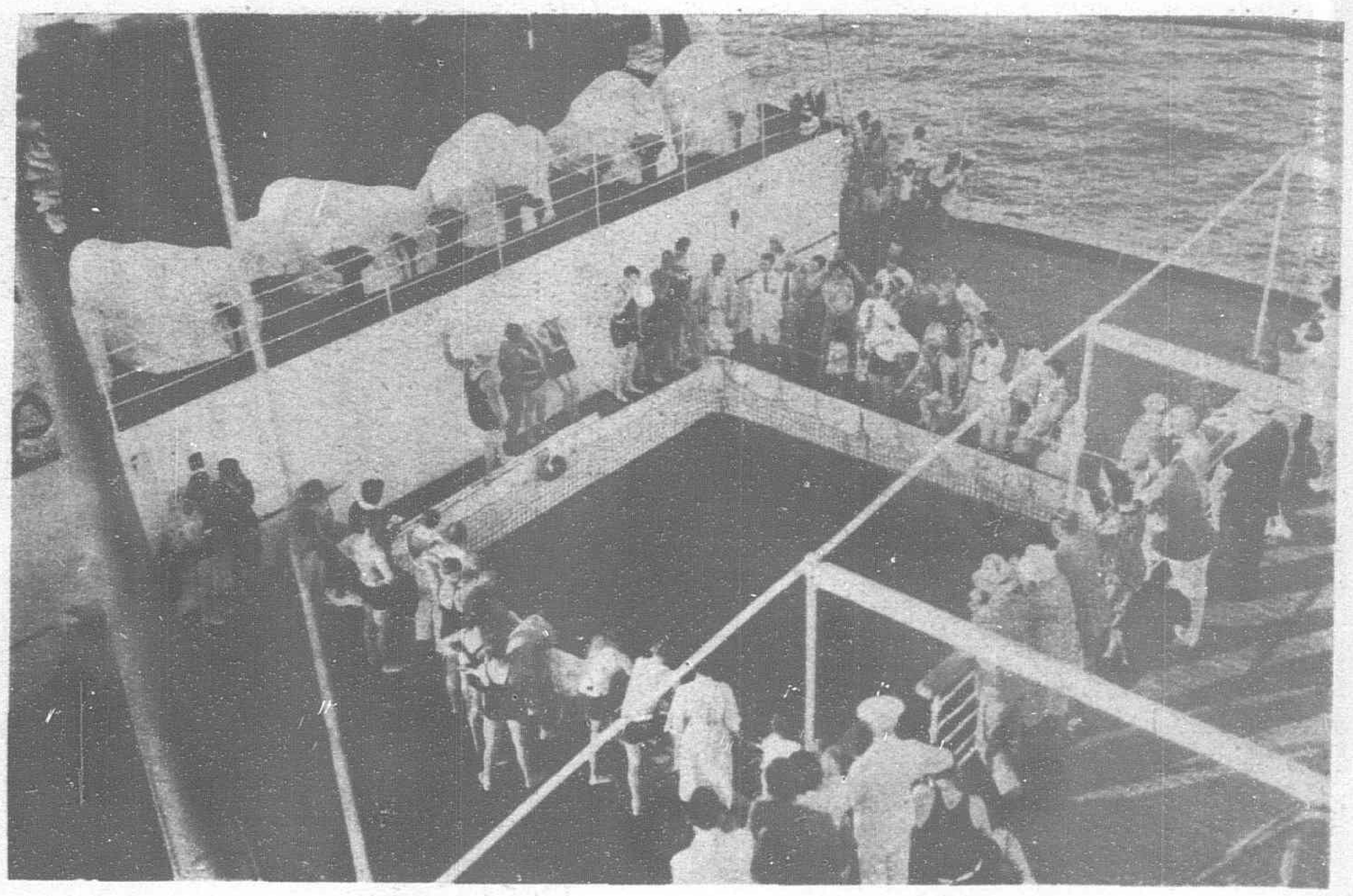
Electrification of the auxiliaries includes devices for the comfort and convenience of passengers, cargo and crew, such as elevators, dumb waiters, electric cooking equipment, deck cargo handling gear, boat handling equipment, warping winch, etc. Power for all auxiliaries, including refrigeration and lighting, is supplied by four 500-kilowatt, General Electric turbine-driven generators which furnish direct current for this purpose and for exciting the propulsion motors.

By means of a CO_2 compression brine circulating type refrigerating plant, with motor-driven brine circulating pumps, refrigeration is supplied to 60,000 cubic feet of cool air space, and 40,000 cubic feet of frozen cargo space.

A Comparison

According to comparisons worked out by engineers of the General Electric Company, the enormous horse-power generated aboard the *Pennyslvania* is equal to the man-power of 557,172 men. If all the inhabitants of Norfolk, Va., were able-bodied men and could work continuously, they could not do the same quantity of work as that put forth by the *Pennsylvania*.

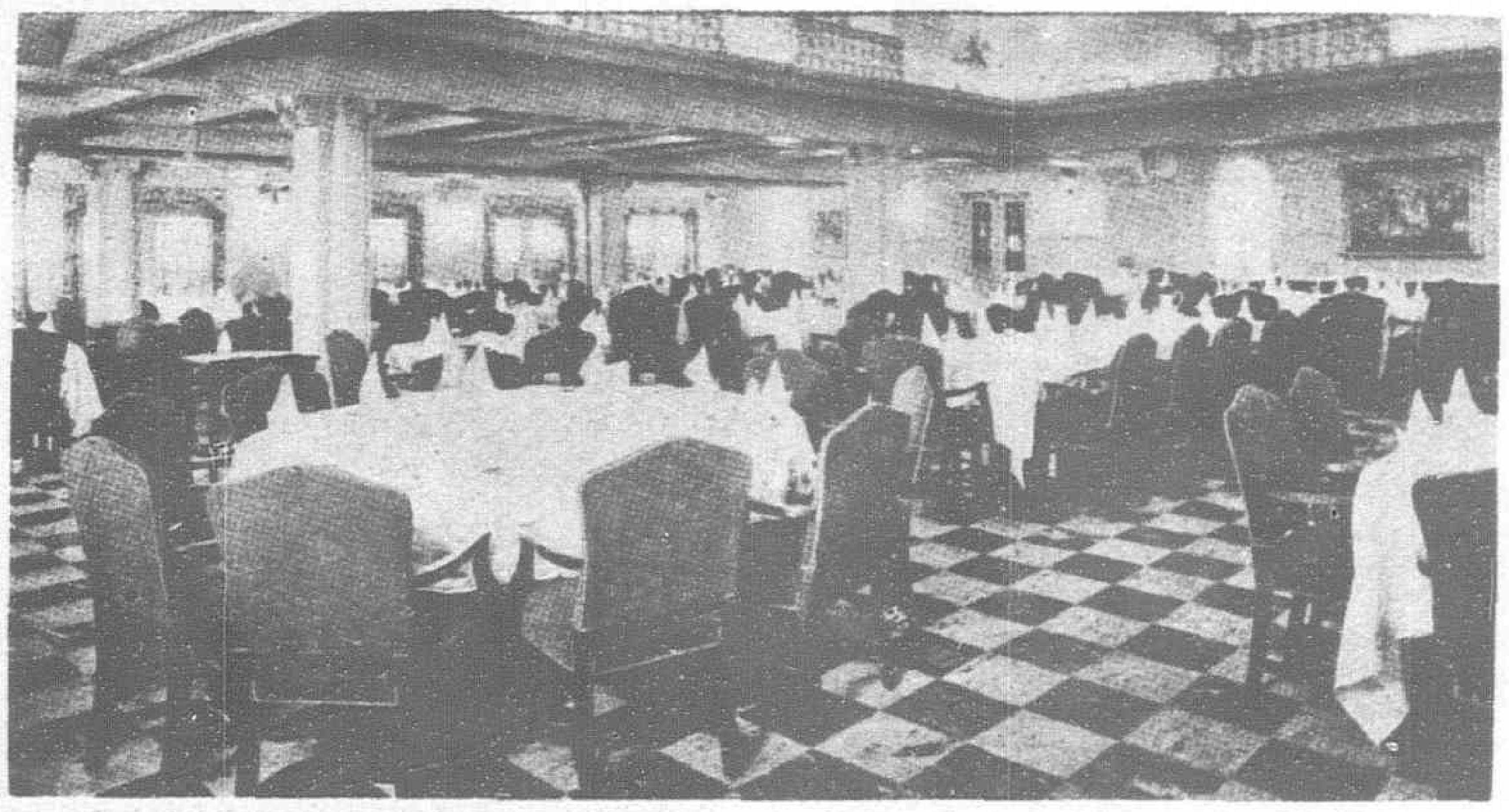
The two turbine generators on the *Pennsylvania* deliver 17,688 horse-power every hour of the day. As each horse-power is equivalent to the muscle work of 10½ men, the 17,688 horse-power on the ship would be equivalent to 185,724 man-power. The population of Norfolk in 1928 was 179,200, or 6,500 under the man-power of the vessel.



Swimming Pool Aboard the "Virginia"

But man's recognized work-day is eight hours, whereas the turbines can and do work 24 hours a day. Therefore, the power generated to drive the *Pennsylvania* is equal to the man-power of a city of 557,172 population or the size of Norfolk, Richmond, Newport News, Roanoke, Lynchburg and Petersburg combined. Census figures of 1928 give the total population of these six cities at 561,600.

Like the two sister ships, *Virginia* and *California*, the *Pennsylvania* is free from vibration—a feature of the turbo-electric drive. These vessels glide through the water silently and smoothly even at full speed, and until they become accustomed to the absence of noise and vibration, passengers when within the doors have the sensation that the ship is stopped.



General view of Spacious First Cabin Dining Saloon

This, however, is only one of the many advantages of this form of propulsion which have been briefly outlined by Mr. Eskil Berg, marine specialist and consulting engineer of the General Electric Company, as follows:

Electric transmission gives a simple and practical means of speed reduction between the high speed turbine and the slow speed propeller in almost any ratio which may be desired.

It affords means of reversal by simple change of electrical connections, without changing the direction of rotation of the turbine. Any desired reversing torque up to the full power of the turbine can be obtained without affecting the efficiency of the equipment in the forward direction. Reversal is obtained with a minimum amount of steam drawn from the boilers, as the full inertia of the turbo-generator is first used in the act of reversal and, in fact, in most cases actual reversal is obtained without drawing any steam from the boilers and steam is only used from the boilers to accelerate the propeller speed in reverse rotation.

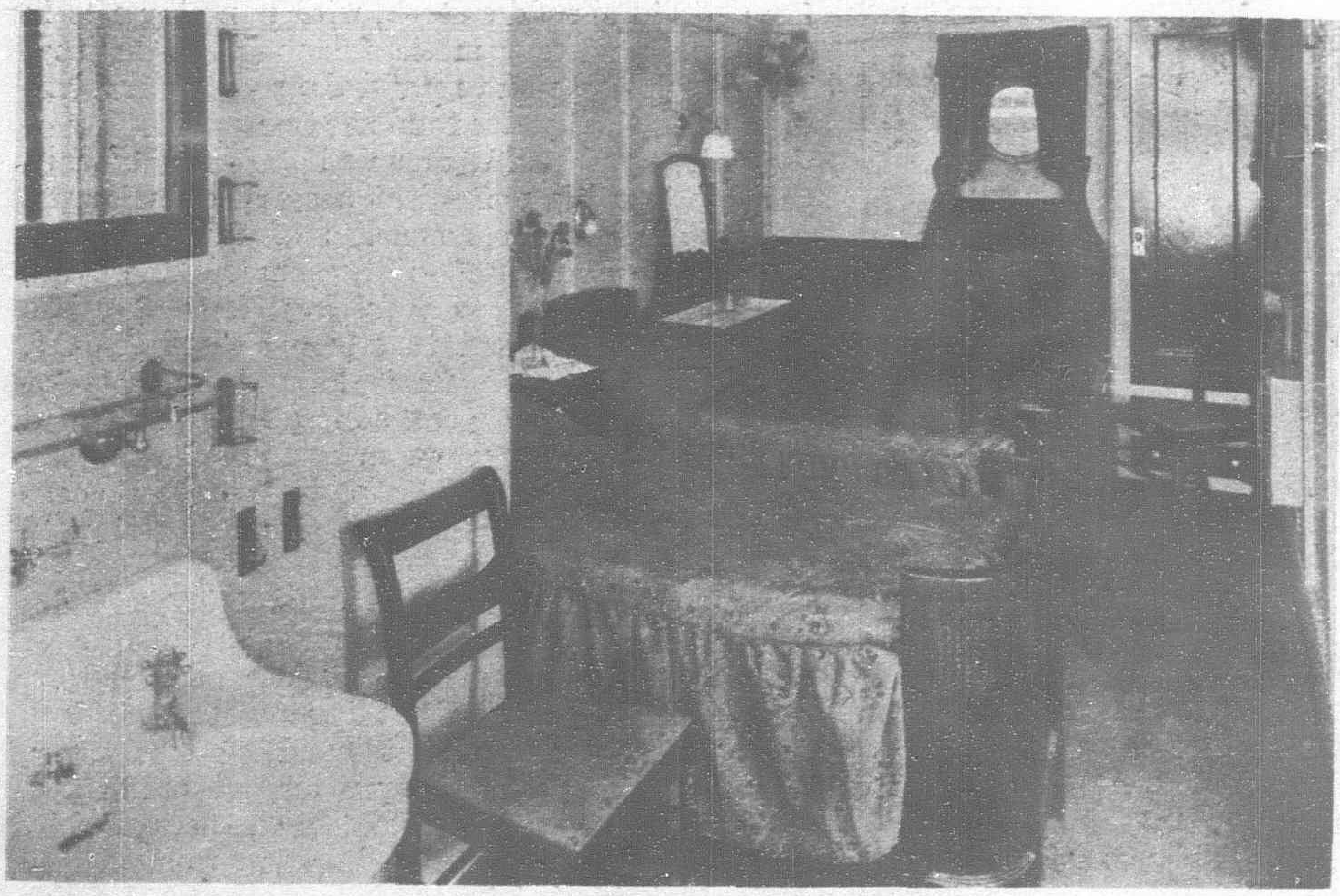
Electrically driven vessels can be made noiseless whereas gears always make more or less noise.

Economy of Electric Drive

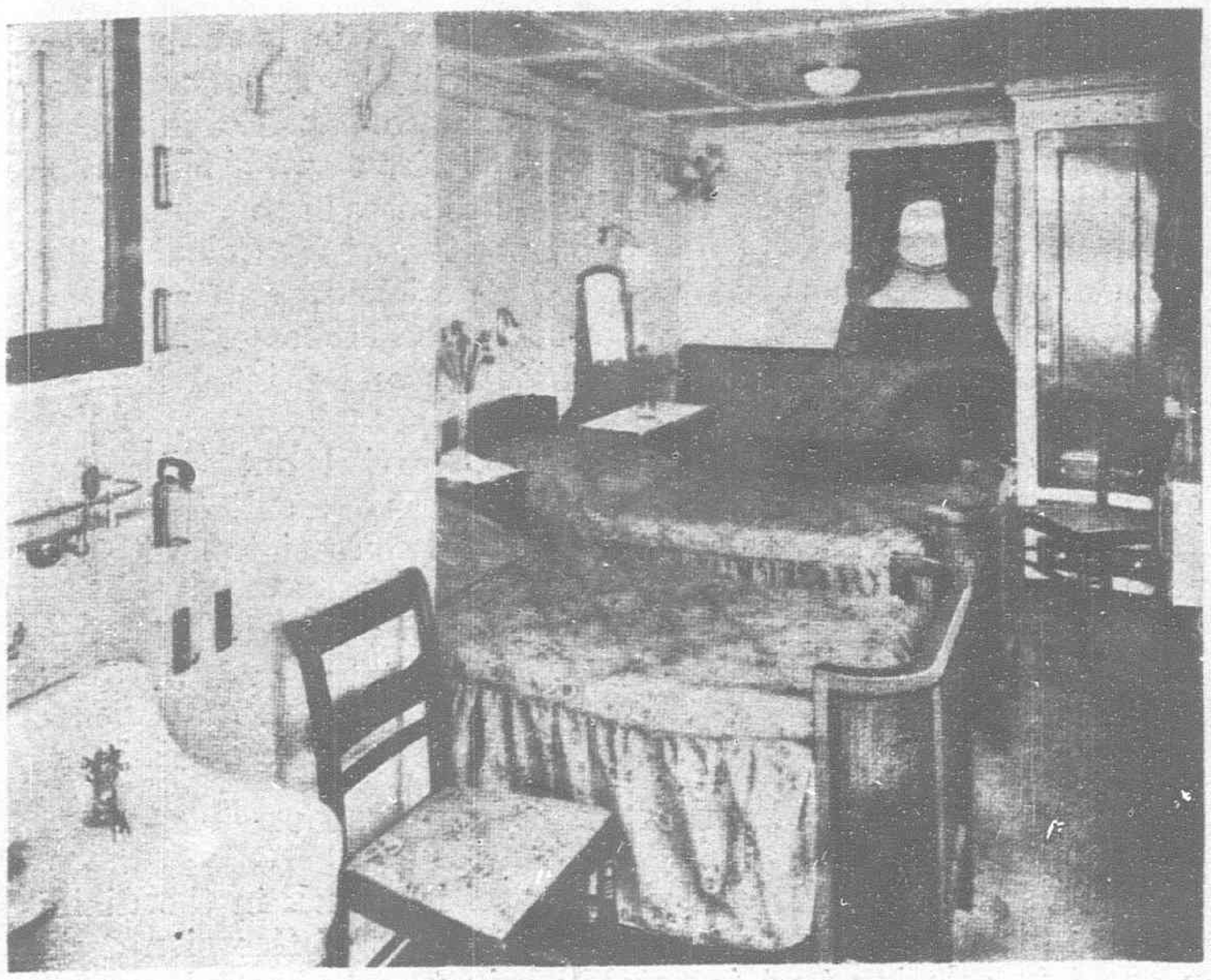
Electric drive makes it possible to obtain accurate data, either by instantaneous readings or by recording instruments, of the load on the propeller shaft under various conditions of sea and wind. It eliminates the use of torsion meters. The total horse-power hours are recorded during any given time or journey. It makes it possible to have a real check between fuel consumption and horse-power hours developed—which means a constant and continuous check on economy.

Experience in maintenance on the electrically built ships by the General Electric Company has shown that the upkeep of the electrical machinery has been practically nil so far.

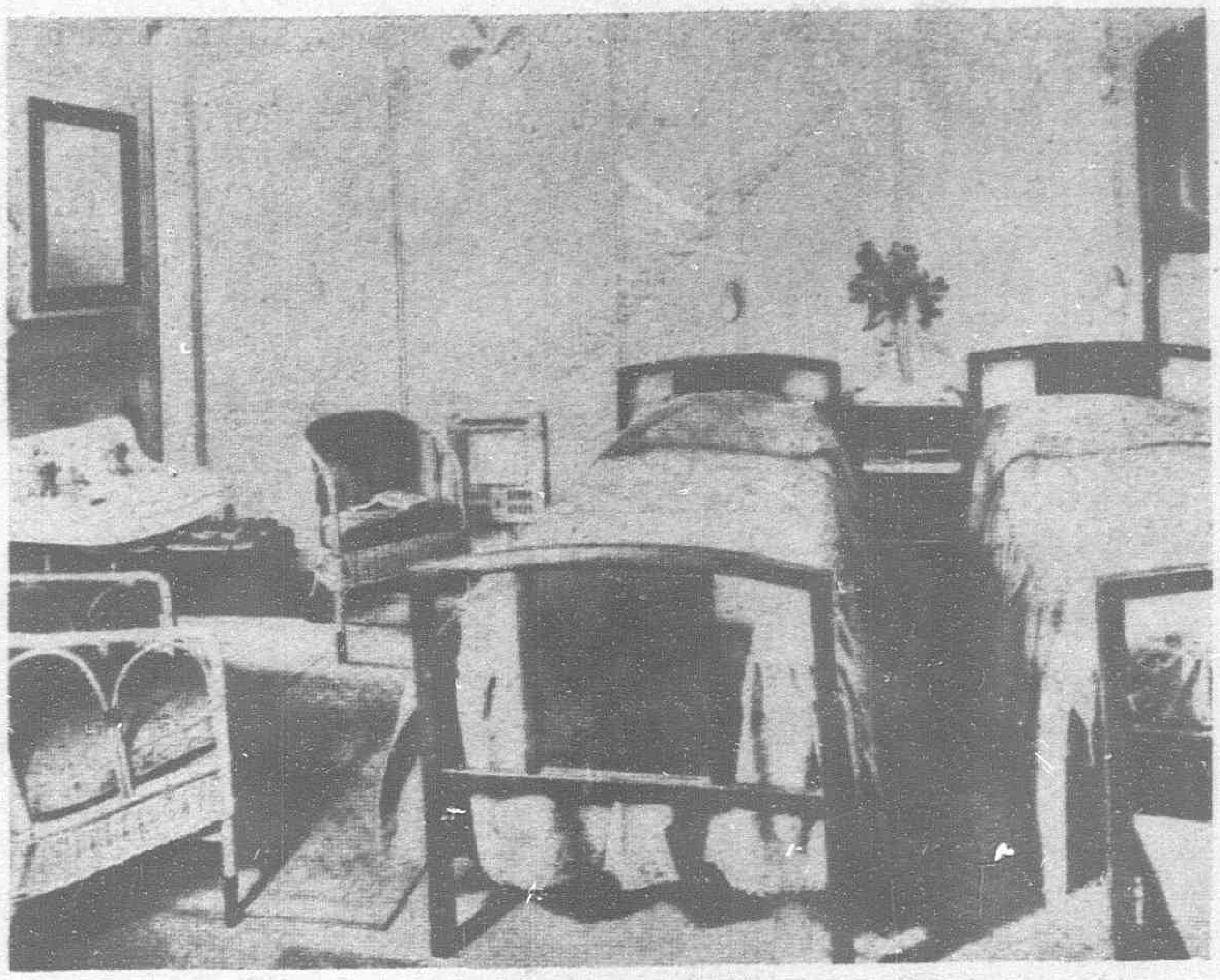
In the design of the generators and motors special precaution has been taken so that, should for any reason a damage occur to any part of the windings, this can quickly be repaired, or temporary quick repairs can be made, so that



First Class State Room on the "California"



Typical First Cabin Bedroom



"Tandem" Bedroom

the ship can proceed at slightly reduced speed. Multiple circuits are used in the generators and motors so that in many cases (for instance, if a coil is damaged) it can simply be cut in two by a hacksaw, the ends insulated, and the loss in power will be only the ratio of this one circuit to the total number of circuits in multiple. So, for instance, if the motor has ten circuits in multiple, and one circuit is cut out, the power is reduced only 1-10th, which will be practically unnoticed, and the repair should take only a few minutes.

Electric drive in many cases may afford important advantage because the generating unit, or units, can be placed in any convenient place near the boilers. They can be mounted at any height desired. The condensers can be put directly under the turbines, thus reducing the steam and the exhaust piping to a minimum. Chances of air leaks, which are so detrimental to obtaining a vacuum are reduced to a minimum. The propelling motors can in many instances, be put near to the propellers, eliminating long expensive shafting and the bearing losses incident to the same. Shaft alleys can be eliminated, thus saving hold space.

Decorations Early American

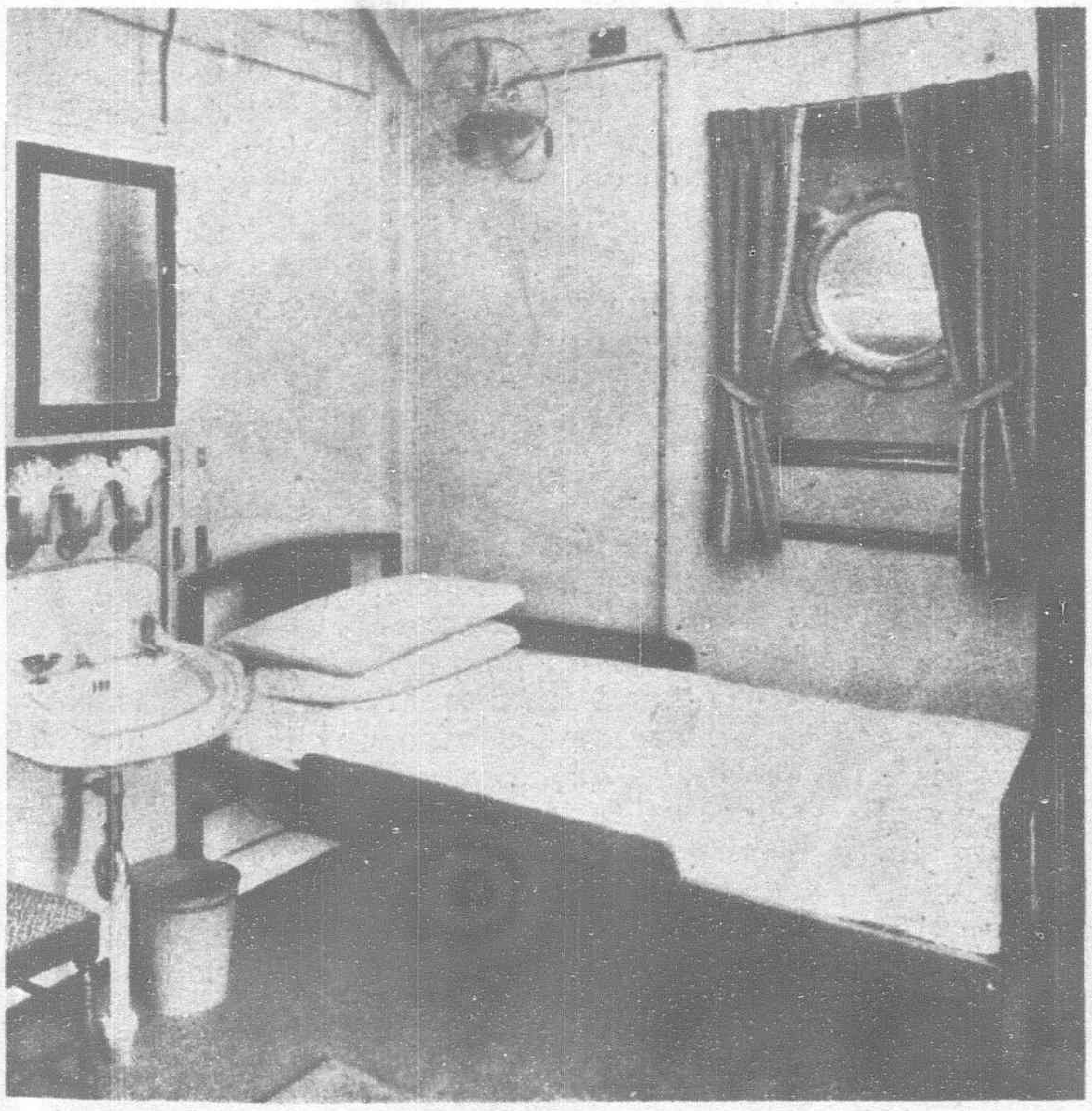
In interior fittings the vessels emphasize the early American spirit in decoration. The style adopted was inspired by the best Colonial models, from the Georgian panels and pillars in dining-saloons and drawing-rooms to the old pine paneling in smoking-rooms.

These classic American forms of decoration are brightened and set off by exceedingly colorful draperies, floor coverings and upholstery that are also strictly true to period.

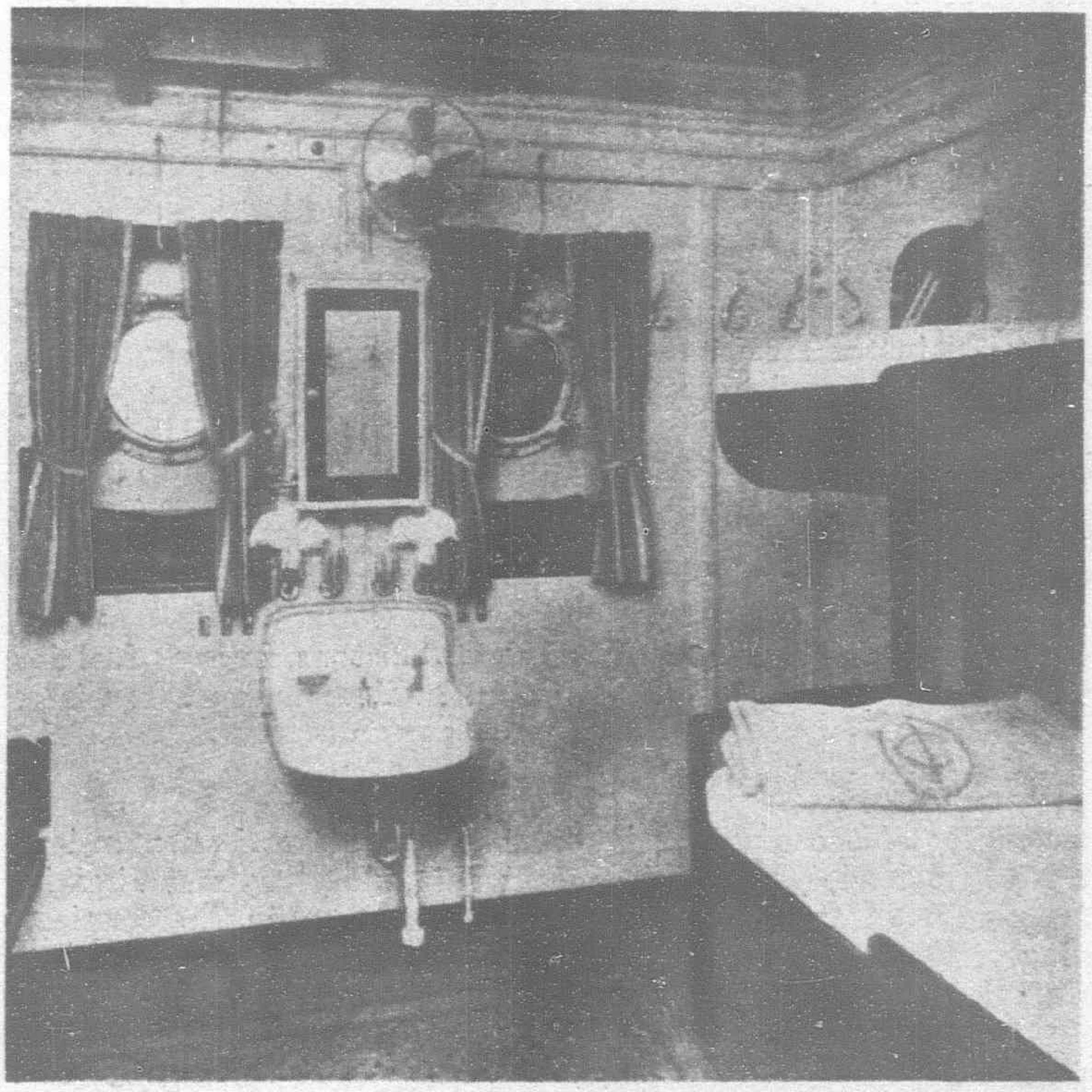
The *California* has capacity for 388 passengers in first cabin, and 363 in tourist cabin. Passengers quarters in the two cabins vary but slightly in elegance, and class distinctions are minimized in every way.

Space for Recreation

Special thought has been given to providing the vessels with unusual space for outdoor recreation. Decks are exceptionally broad. There are great spaces for deck sports and promenading,



Tourist State Room



Tourist Bedroom with two Ports showing Hotel-type Bed, Pullman Berth and Couch ample room for rows of deck chairs in shady spots, and a verandah café like a summer garden.

Two swimming pools of new type set a new fashion in ship construction, as they are out of doors and are of the built-in type, with water slightly below the level of the deck. The pool for first cabin is 29 feet long and holds ninety tons of water. That for tourist cabin is nearly as large. Clear cool sea water is supplied, and frequently renewed.

Dancing, another popular diversion on the coast to coast voyages, is provided for in both an outdoor and an indoor ball-room.

In freight carrying equipment the ships are no less distinctive. There are in 60,000 cubic feet of space for cool-air cargoes—largely California fruits—and 40,000 cubic feet of refrigerated space. Temperature in the space for fruit is regulated by purified air passed over brine pipes and circulated by huge electric fans.

Interesting Details

The *California*, with her cargo, stores, fuel, water and passengers on board, weighs slightly more than 30,000 tons, and displaces an equal weight of water, which gives her displacement, 30,250 tons.

Weight of steel in the *California's* hull is 8,500 tons. The number of rivets used in building the ship was 2,778,000, weighing 425 tons.

The ship has eight decks, the area of which, with the floor of the lower hold, is 7.2 acres.

The interior measurement of the ship's hull and enclosed superstructure is 2,717,000 cubic feet, equal to the living space in 270 average dwellings of eight rooms each.

The distance from the top of the *California's* mainmast to her keel is 180 feet 4 inches, and from the top of her foremast to the keel 175 feet 4 inches.

From the top of the *California's* smoke-stacks to the keel the distance is 133 feet 4 inches. The stacks above the deck are oval, being 19 feet in one dimension and 24 feet in the other. The rear stack is used for ventilating purposes only. From the top of the pilot house to the keel the distance is 99 feet 6 inches.

The *California* has a subway, but it is never used by the public, it being a steel passage, far down in the hull, under passenger accommodation and freight holds, by which the fireroom attendants may pass from their work to their quarters, and the reverse, without going on deck. It is 120 feet long.

To facilitate the handling of package freight, stores and passengers' automobiles, without hoisting, and for passenger gangways, the *California* has in the sides of her hull a total of 26 ports. The largest are eight feet wide by seven feet four inches high. When at sea these ports, although well above the water line, are closed with powerful steel clamps.

The *California's* rudder has an effective area of 394 square feet, and with its stock, weighs 45 tons. It is of the balanced type, and was designed for safe steering at low speeds in the Panama Canal.

The *California* carries a crew of 370 souls. There are 225 employed in the service department, 70 in the deck department, and 75 in the engine room staff.

The *California* carries, each voyage, one way, 2,335 tons of fresh water, for baths, cooking and drinking. All cooking and drinking water passes through huge charcoal filters before entering the distribution pipes. For use in emergencies—which are remote—the ship has a complete plant for distilling sea water and making it fresh and palatable.

Oil tanks on the *California* hold 5,349 tons, enough fuel for a round voyage of 11,000 miles between New York and San Francisco.

In Early American Style

Study of the dignified interiors of early American mansions in New England, New York, Pennsylvania, Maryland and Virginia, and notable examples of Colonial rooms preserved in the American wing of the Metropolitan Museum of Art at New York, inspired the style in which the vessels' public apartments have been decorated.

In the larger rooms, such as the drawing-room and ball-room lounge, purely Georgian design, as expressed in leading Colonial examples, has been followed. In the smoking-rooms, natural pine panelling of early local origin, which now is having a merited revival, has been cleverly adapted.

Wherever possible, native American woods have been employed. Panellings, pillars and carvings in the larger rooms are of white pine, finished in tints. Foyers are panelled in stained oak. Staircases are in oak, with wrought iron and aright bronze rail grills of classic design. Electric light fixtures have been fashioned in appropriate forms of brass and pewter, or for Colonial silver finish. Hardware has been specially designed, and rugs and carpets specially woven to carry out the general scheme. Draperies are in damasks, tapestries, bright chintzes and printed linens of Colonial patterns.

This devotion to a national style, carried out with equal faithfulness in first and tourist cabins, has resulted in both originality and a vivid coloring not usually associated with ship interiors.

All interior decorations in the ship are the work of Barnet Philips Co., prominent New York decorators, and J. Philip Kiesecker Associate.

Keynote Struck in Dining-saloon

The keynote of the style employed is struck in the dining-saloon, which combines with the classic forms of Georgian design an effect in coloring that is notably bright and cheerful.

In a dome, or recess, over the center of the room, mirrors are introduced, that create a feeling of space and distance, and before each is a wrought iron rail, as on a balcony.

The ports in the ships' sides are concealed in groups by leaded glass windows, having hangings of glazed chintz, in bright designs of flowers and fruits. Chairs of Cuban mahogany are upholstered in grayish-blue mohair. The floor covering is rubber tile, in alternate squares of cream white, grayish-black and claret, with border of black and green.

Electric fixtures include tall, old silver candelabra, standing in coves, or niches. A long sideboard, and a serving buffet of original design, are in mahogany with ebony carvings of unusual design and beauty.

Library in Apple Green

The striking character of the decorations in the public rooms again is emphasized in the drawing-rooms, farthest forward of the apartments on "A" deck.

The walls of this room are tinted in cool apple green. The carpet, an American-woven Saxony, has a dark prune ground with gold rosettes.

The room extends across the entire width of the deck house, the forward end being slightly curved. Window openings are of the proportions of a standard house window, with hangings of mulberry-and-gold damask, in a brocaded floral design. Seven of these window ports are in the broad front of the room, and give a direct view across a shelter deck, of the sea ahead, when the ship is under way.

The lightng fixtures here are gold with black striping, and details of hardware and decorations are particularly delicate and true to period.

Lounge is Also a Ball-room

The social center of the ship, the lounge, combines the features of a spacious living-room and a ball-room. Its dimensions are 46 by 50 feet, and its floor space is in excess of that of an ordinary dwelling.

Outstanding architectural features of this handsome room are a great bay window, fourteen feet wide, on either side ; a stage 16 feet wide, for the dance orchestra, and for use in concerts ; a wood-panelled ceiling ; walls done in French gray, divided into panels by pilasters having carved caps and a dome, in the Georgian style, with glass and grill panels alternating in its sides. On the wall opposite the stage is a broad mirror cut in small sections, set with crystal rosettes, and beneath it is a wide stone jardiniere, filled with growing flowers, giving freshness and life to the design.

There is a hardwood dancing floor throughout the entire space in the lounge, covered with deep-pile rugs, the color being two tones of blue and sage green with a border of deep blue having a brick red design. All or part of these rugs can be taken up in a few minutes when space is desired for dancing.

Lounge Lobby Writing-room

Off the lounge, on the right as one faces toward the stern, is a lobby, or writing room, 30 feet long, that is most strikingly decorated. The walls are panelled in two tones of *cafe au lait*. The hangings of the large windows are in *tete de negre*, or two tones of brown, with a stripe of gold thread. There are two desks, a sofa upholstered in aqua marine, settees and chairs, all in satinwood, and on the walls paintings in architectural style, depicting scenes on the Panama Canal.

This apartment opens directly into the smoking-room.

Early Colonial Smoking-room

With walls paneled in ripe old pine, a timbered ceiling, a carved wood mantel, an oak sideboard of the cupboard type, and lighting fixtures that include watchmen's hexagonal lanterns in brass and pewter, this room represents the essence of early American decoration.

The idea for its design is embodied in a room preserved in the American Wing of the Metropolitan Museum of Art—the kitchen of the "Parson" Capen house at Topsfield, Mass., built in 1674.

This dignified background is brought out by an abundance of color in hangings and floor coverings, rich blue leathers in sofas and arm chairs, old English linens in soft shades at the ports, and exceedingly rich combinations of rubber tiling on the floor. On the walls are old engravings, in Hogarth frames.

Every State Room an Outside Room

In ordering the vessels, the owners laid down the principle that every state room must be an outside room. Hence every one of 750 passengers may sleep in a room with outside light and air.

There are 32 bedrooms with connecting private bath, 17 with private shower baths, and 64 with private toilets. There are also suites with private sitting-rooms.

First class rooms are all equipped with beds having springs and hair mattresses, sofas and full length wardrobes with mirrors in the doors. Each room has running hot and cold water, an electric heater in a heavy white porcelain setting, and a powerful, silent electric fan, besides mechanical ventilation.

Each room is decorated in soft, harmonious and cheerful colors, the principal shades employed being light green and rose. Furniture of special design is in fine woods having the "high light" finish of old maple or walnut, and is upholstered in damask or similar fabrics.

Tourist Cabin Establishes New Standards

Tourist cabin (not to be confused with "tourist third" to and from Europe) originated with the Panama Pacific Line, and established new standards in ocean travel. In building the new vessels the company had opportunity to create for "Tourist" accommodation no less comfortable than that in first cabin, and nearly as ornate, in which everything is designed to give satisfaction to the traveler who seeks the best for his money on a modest budget.

Experienced travelers who have seen the Tourist accommodation on these ships, marvel not only at the spacious completeness, but also at really luxurious appointments, and the unusual taste and balance of its decorations.

"Tourist" has its own broad promenade deck. Its public rooms are large, airy and pleasingly decorated. The lounge, 42 by 48 feet, is panelled in old ivory, with hangings of rose, in small patterns, at windows of leaded glass. The floor has rubber-tile covering, in alternating squares of harmonious colors. Furniture is upholstered in tapestry. The same attention to color harmonies and appropriateness is evident here as in the ship's other public spaces. The dining-saloon, extending the full width of the ship, is 73 by 38 feet, with tables for two, four or eight people, and a beautiful mahogany buffet, in the Heppelwhite style. The walls are in soft tones, and lighting fixtures in antique silver finish. Over the center is a dome with Colonial panelings. Service is from the same kitchens that serve first cabin.

In the tourist cabin smoking-room are panelings of old pine, and hardware and electric fixtures of antique brass. Furniture is upholstered in leather and tapestry. There are tables for cards and refreshments, placed in cozy niches, giving privacy and comfort. The room is 46 by 29 feet, and occupies a deck house of its own, with ports on four sides.

In every tourist cabin state room there is a bed, taking the place of a lower berth, and used in combination with bed-berths of a new type. There are rooms for two, three and four persons. All are equipped with high-grade bedding and floor coverings, running water at a fixed porcelain bowl, a clothes closet and an electric fan.

Kitchens, Pantries Have Electric Equipment

In arrangement and equipment, the kitchens are electrically equipped throughout, the only fires used being under the nickle-silver broilers, where charcoal is employed as fuel, to bring out the flavor of steaks, chops and chickens.

There are ten heavy Edison-type ranges in the main galley, at which cooking can be done for 1,200 persons without difficulty. Electric accessories include a great salamander for baking meats, a potato peeler holding a bushel; choppers and mincers of equal capacity and toasters that will brown 16 slices at once.

Steam is employed for boiling, in double-jacketed kettle, some of which hold 60 gallons each. A kettle of 20 gallons is considered moderate in size. All steam used in the kettles is first purified in an evaporator and clean steam producer—in fact it is laundered.

Egg boilers are fitted with an electric timer, which takes the eggs out of the water at the required second.

The ship's bakery, one of the finest of its kind, also is electrically equipped. There are two main ovens, with a capacity of 180 one-pound loaves each; an electric dough mixer with a capacity for two barrels of flour at a mixing, and various minor electric devices, including "whiskers," for beating eggs or creams.

The pantry arrangement for serving food necessarily is elaborate. There are four separate pantries, the largest being that connected with the first class dining-saloon. There is another for the tourist cabin saloon, one for the officers and engineers, and another for the crew.

A Sea Going Garage

Transportation of automobiles on ocean liners is no new thing, as it has been the custom of the transatlantic lines in recent years to accept passengers' automobiles as excess baggage. In recent years these cars have been handled uncrated, which has led to a marked increase in the numbers transported.

Until the *California* was built, the cars were handled aboard ship much like freight. They were hoisted aboard in slings, and placed in vacant space in a freight hold.

The space reserved for the *California's* garage, amidships on "E" deck, is reached through wide ports, or doors, in the side of the ship. Wide gangplanks have been built to reach these ports from the dock.

When a car is to be put on board there is no need of slinging it for hoisting. It is rolled to the foot of the gangplank, and a light wire cable is attached to it. This cable leads to an electric winch in the garage. A turn of a switch, and the car starts up the gentle incline of the gangplank, with a man at the wheel to guide it, as if it were under its own power.

Inside the garage are compartments formed by heavy timber uprights, set in sockets, and removable. When a given section of the garage has been filled, and the cars have been fastened to the floor by lashings passed through the wheels and attached to convenient ringbolts, the partitions are put up, shutting off the space, though it is still open to inspection and the circulation of air through the open spaces between the uprights.

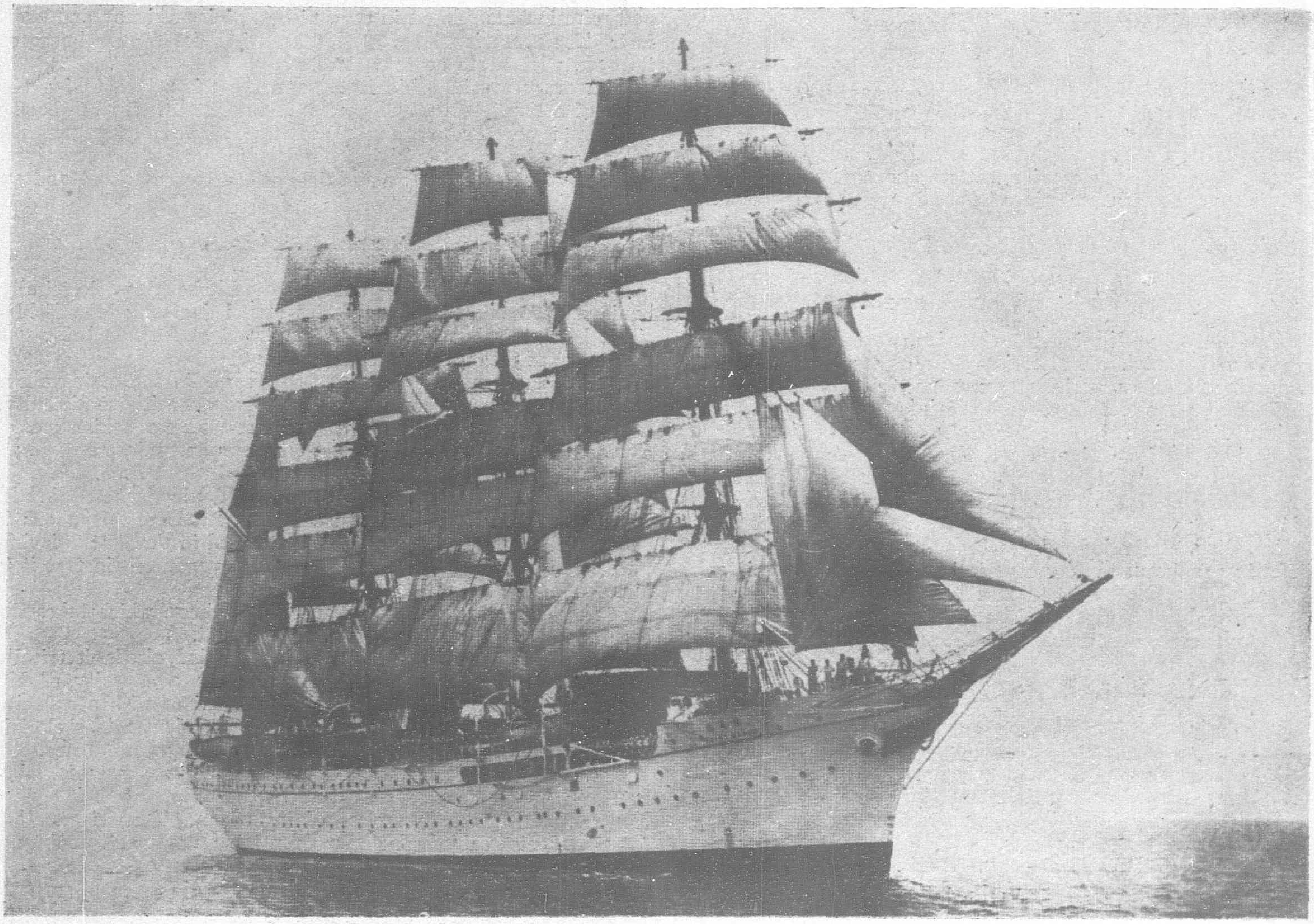
This system of stowing cars gives each car as much space as it would have in a garage. It also makes unauthorized visits to the car impossible.

Flies Famous Flag of Old American Line

In her house flag—the ensign of the owners—of the Panama Pacific Line, newest and largest of American-built steamships, has a symbol known to ocean travelers for the past fifty-six years.

It is the old and honored insignia of the American Line, for more than fifty years identified with de luxe transatlantic travel,

(*Continued on page 654*)



The "Kaiwo Maru" under full sail

The "Nippon Maru" and "Kaiwo Maru"

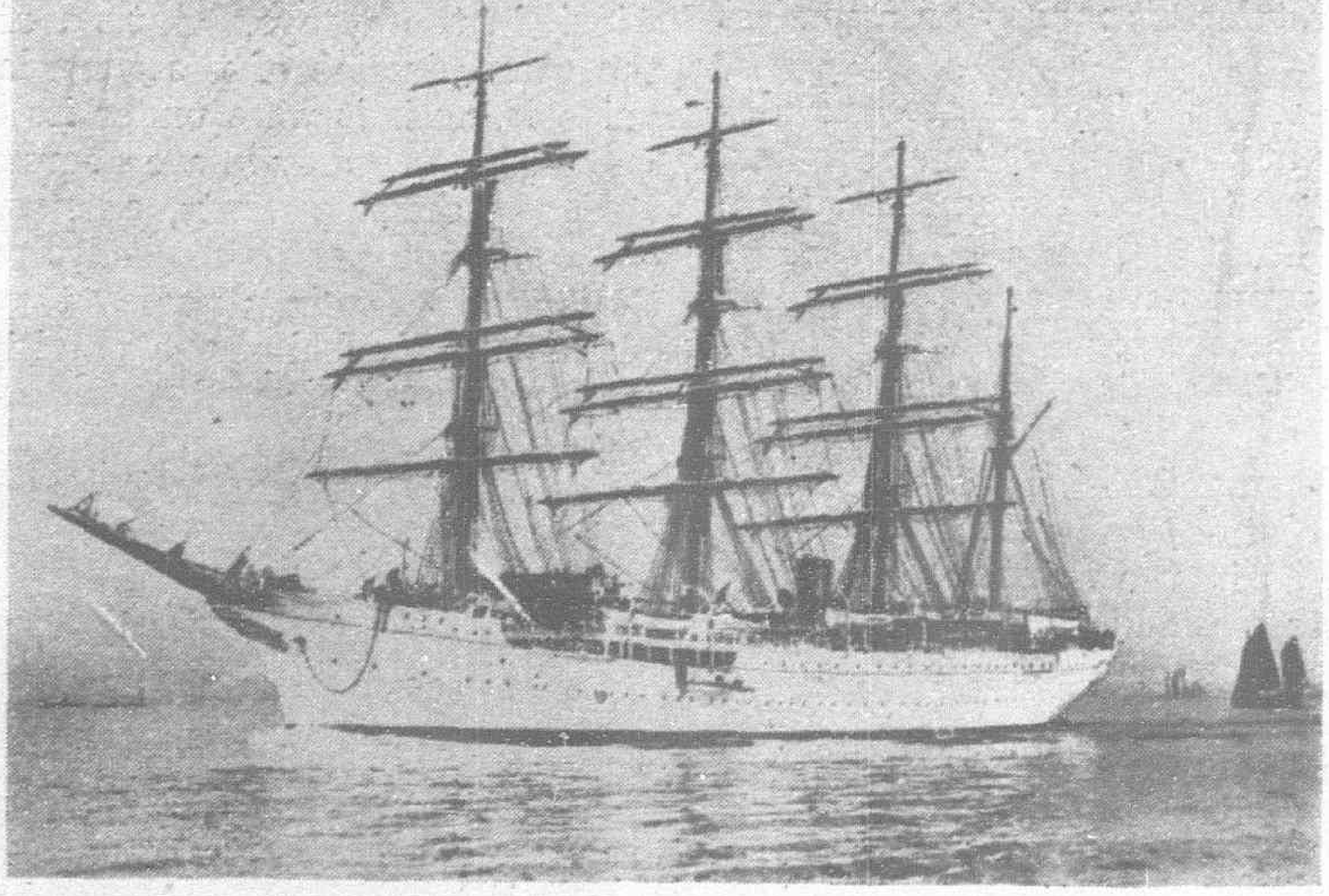
Two modern Japanese training barques with auxiliary Diesel propelling machinery

The vessels were built in the Kawasaki Dockyard of Kobe to the order of the Institute for Nautical Training of the Ministry of Education for the sea training of undergraduates of eleven navigation schools in Japan.

The initial design of these vessels was carried out by the building committee appointed by the Government, comprising professors of the Tokyo Imperial University and the Tokyo Higher Navigation College and officials of the Mercantile Marine Bureau, so that it embodies many interesting characteristics.

LEADING PARTICULARS.

Length b.p.	260′-0″
Breadth mld.	42′-6″
Depth mld.	25′-9″
Length of forecastle	37′-3″
Height of forecastle at fore end	8′-9″
Height of forecastle at aft end	8′-0″
Length of poop deck	185′-9″
'Tween deck height (upper and 2nd dk.)	8′-0″
Gross tonnage	2,283.98 tons.
Type of rigs and No. of sails.	four masted barque with 35 sails.
Propelling Machinery :—	Two sets of Ikegai Airless inject. Diesel engines.
Total b.h.p.	1,200
Number of screws	2
Trial speed by engine	11.445 knots.
Complement :—	
Officers and crew	66
Cadets under training	120

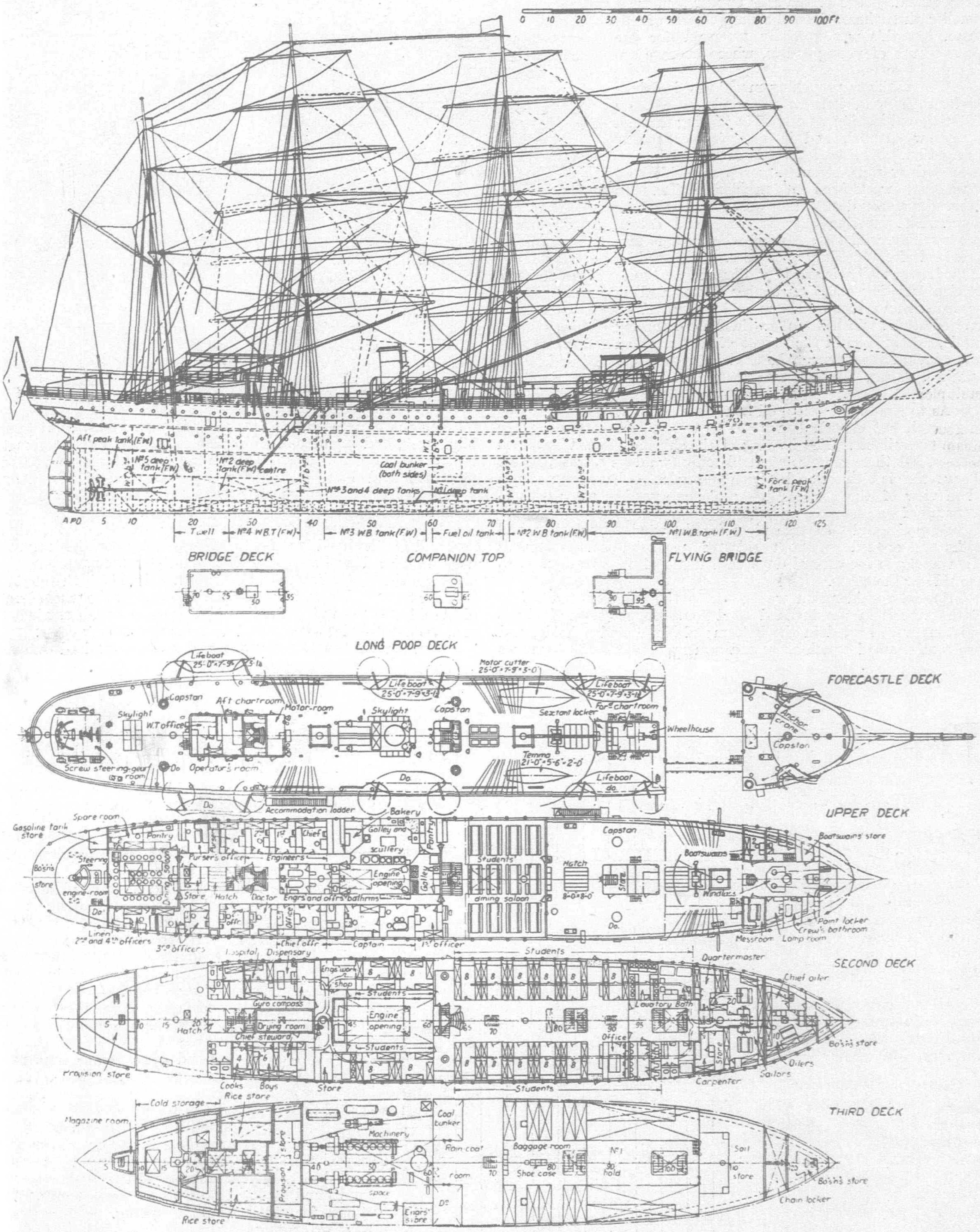


The "Kaiwo Maru" under screw propulsion

General Arrangement and Special Features

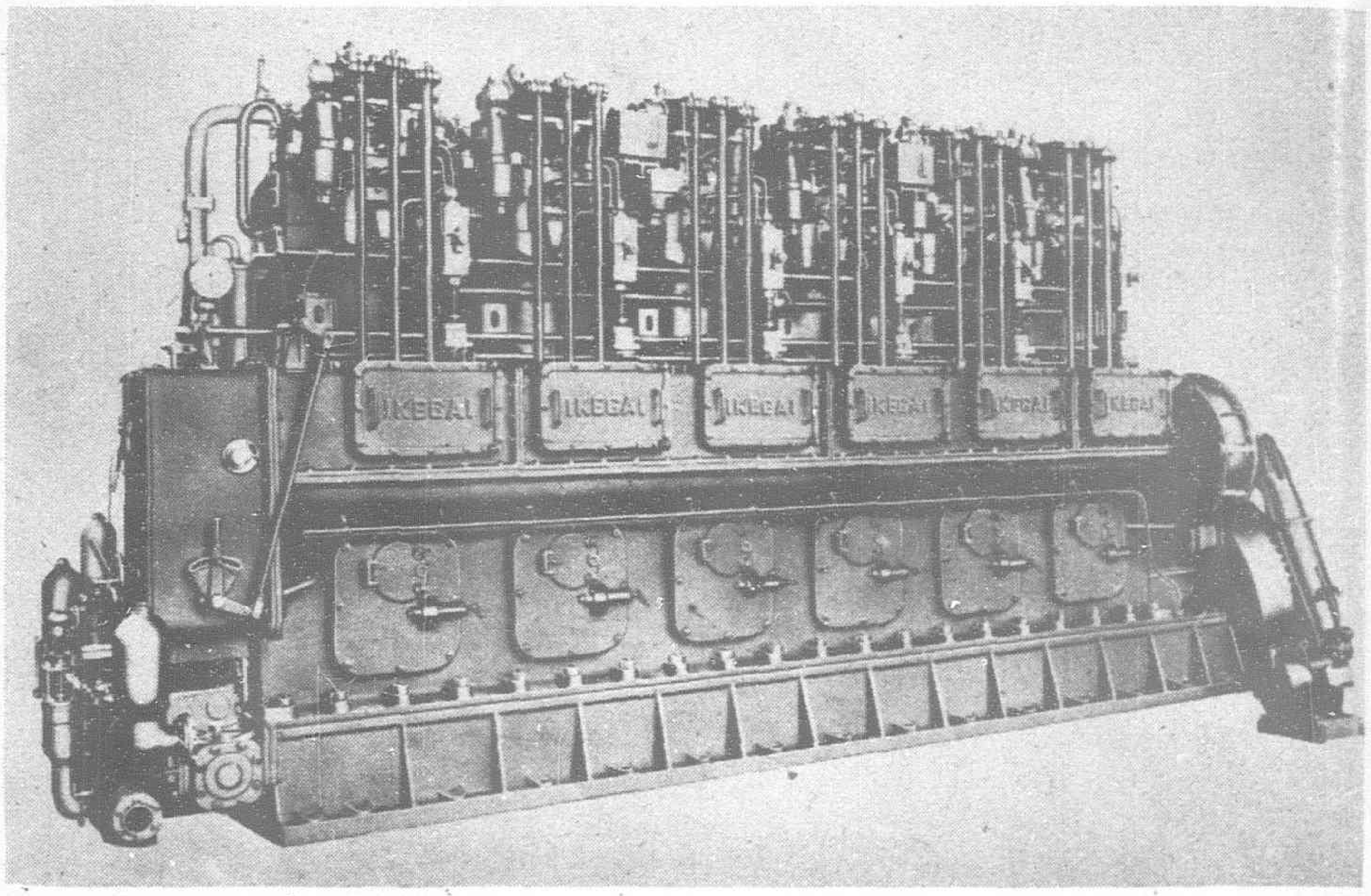
The ships have a clipper stem with a figure head of the Imperial Crest and a bowsprit. The stern counter is decorated with beautiful arabesques, while the hull is painted snow-white with a distinct black moulding line.

In view of the great importance of the sails and sail fittings in these ships, they were



The "Nippon Maru" and "Kaiwo Maru"—General Arrangement ordered from Messrs. Ramage and Ferguson & Co. of Scotland. Sizes of the sails appear somewhat smaller than those of usual sailing vessels of this type, but this was specially arranged for the convenience of young cadets, whose average age is only 18 years.

The auxiliary propelling machinery is driven under such conditions as no wind on sea, on entering and leaving a port, or in passing through a narrow channel, and in necessity of speedy navigation. Whilst the vessels are in harbor or propelled by sails, steam power is available only twice in a week from an auxiliary boiler. On other days, all deck machinery is driven by hand. The steering gear is also hand driven when sailing, whilst a steam steering gear is also provided for auxiliary purposes. The rudder area is unusually large in order to get quite efficient steering effect on sailing. The windlass is also driven either by steam or by hand. Two sets of steam winches are provided for handling goods, but in case of the failure of steam, seven sets of hand capstans can be used in place of the winches. Thus, all deck machinery is arranged in duplex.

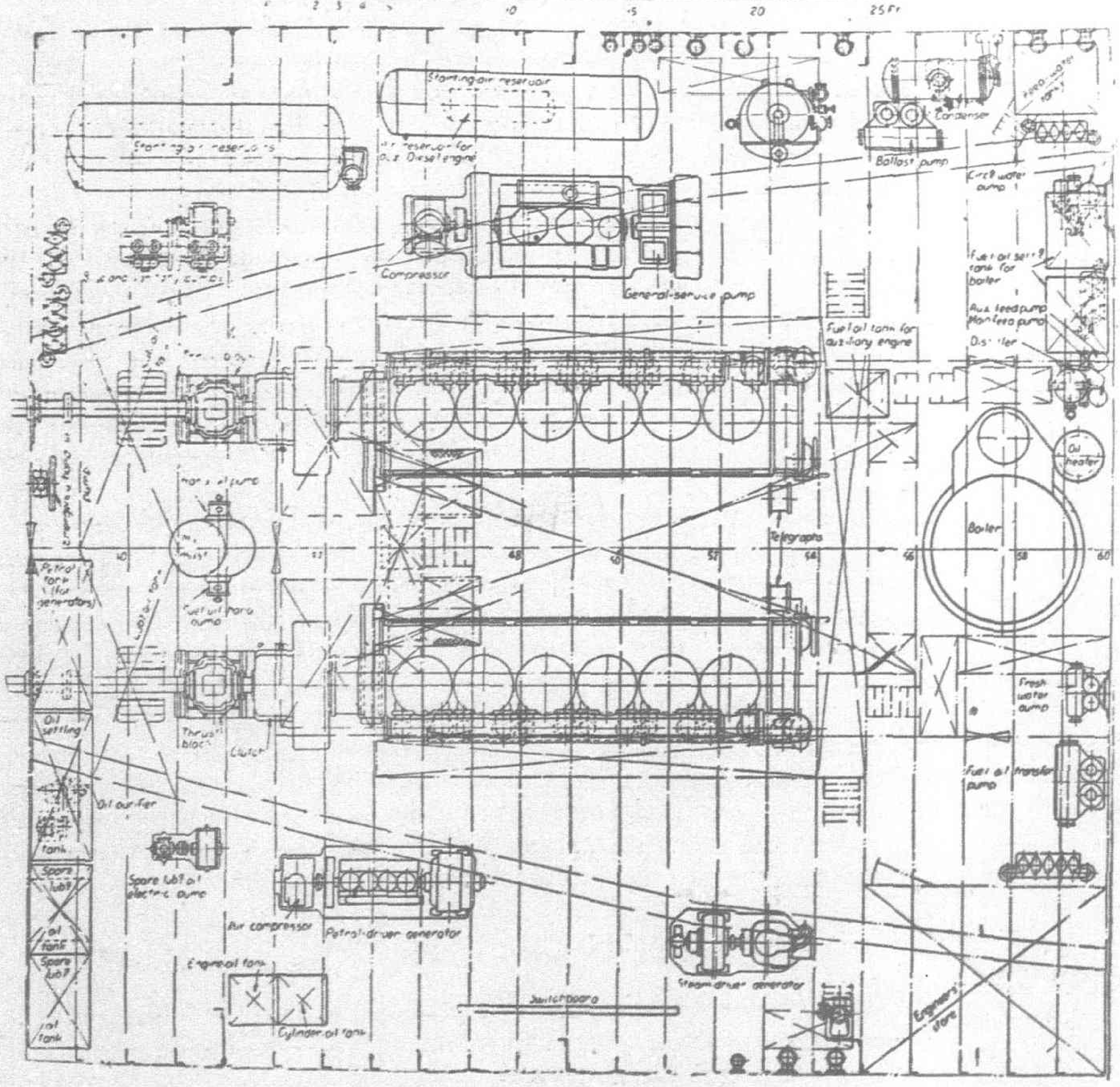


Main Engine "Nippon Maru"

As to the illumination, oil lamps are adopted in general, but electric lamps are lit two days in a week, when steam is available. The heating of the ships is effected by steam heaters, but these are also available only two days a week, unless the weather is bitterly cold. Such arrangements have been adopted in view of the stoic training of young cadets as well as in economy of ship handling.

Scuppers and discharge pipes for the windlass, winches and baths are opened on both sides of the ship, as the vessels often navigate for several days with a list of over 10 degrees to one side or the other.

Special consideration was given to the stability and safety of the vessels in the inclined condition. Copper slugs of about 640 tons were loaded in the bottoms of No. 1 and 2 holds, and also a mixture of punch slugs and cement of about 130 tons was filled in the bottoms of the fore and aft peak tanks, shaft tunnel bilge tank, and engine and boiler bearers, so that the actual metacentric height shall be 3.39-ft. at the service condition and 3.09-ft. at a half loaded condition. For the prevention of vibration, a special structural arrangement was adopted in vicinity of the engine room together with careful balancing of the main engines.



Arrangement of machinery in Engine Room

For convenience of the cadets running over the deck in darkness and for the handling of sails, all projections on the long poop deck such as deck house skylights, ventilators, etc., are arranged either on the center line or at the extreme edges of both the sides, in order to provide two rows of clear passages on the whole length of the ships. Steam pipes for the steering gears, winches, windlass, etc., are fitted under the exposed deck for the same purpose.

THE NAVIGATION APPLIANCES such as the standard compass, steering compass, gyro-receivers, navyphones and all other instruments are fitted in duplicate in the fore and aft bridges, the forward bridge being used in mechanical propulsion, while the aft one in sailing. A steering telemotor of Brown Bros. type, a Kelvin's electric sounding machine and booms are fitted on the forward bridge. Sixty sextants are stored in a sextant room for the astronomical exercises of the cadets.

THE SAFETY APPLIANCES comprise six 25-ft. life-boats, one 21-ft. Japanese junk and one 25-ft. motor-boat, which are able to take the whole complement in case of emergency; the motor-boat has a 35 h.p. Kermath engine and a speed of 8.7 knots was recorded on trial. For the handling of the life-boats, ordinary boat davits and four hand capstans are fitted, while the motor-boat and junk are handled by a 10 ton steel derrick.

THE CADETS' ACCOMMODATION.—A dining-saloon is situated under the forward end of the long poop on the upper deck, and is also utilized as a lecture hall, reading and social room, special care being taken for the lighting and ventilation. Cadets' cabins are on the second deck comprising fifteen bedrooms, each having eight beds. A cadets' office, bath-room, and lavatory are arranged in the forward part of this quarter.

All cooking is done by coal, steam being not available except two days a week as mentioned before. The coal bunkers are arranged below the third deck and communicate with the galley by coal trunks and by hand coal hoists, these trunks being utilized for ventilation and lighting.

Two side gangways are provided at the fore and aft sides of the cadets' quarters, which serve as coaling gates and for ventilation when anchoring. In the aftward gangways, large gutters are provided, the distributing valve boxes for oil pipes to five oil fuel tanks, oil sounding pipes, oilo ver-flow pipes, etc., are assembled there, while over-flow oil in the gutters is collected to the over-flow oil tank in the engine room. Thus, the aft gangways serve as the oiling station.

An engineers' workshop, Sperry's main gyro-compass room, medical room, hospital, infectious disease room, laundry, drying room, etc. are also arranged on the second deck. A large space is provided on the stern part for the cadets' working place in rainy weather.

Machinery Arrangement

The adoption of Diesel engines for the mechanical propulsion despite the necessity of extreme saving in the building cost, is due to the economy of Diesel engines and to the extreme handiness in changing from sail to mechanical propulsion. Under stormy or windless conditions, mechanical propulsion is imperative, but in case of steam engines as in ordinary training sail ships, the boilers should be ready several hours ahead in accordance with the weather forecast. In case of failure of the weather forecast, fuel and labor spent for generating steam are wasted altogether. Besides, steam generation is not at all an easy matter, as water in boilers is usually extracted to keep the boilers dry in order to minimize the corrosion, when they are not in use. Condenser covers and valve boxes are also kept open, so that much trouble is experienced in generating steam in a short time. Further, when the ship is called to the rescue in case of disaster to other vessels, it would be practically hopeless to carry out the duty of mariners, if it is necessary to start the generation of steam first. Diesel engines can overcome all such difficulties and their expense is far less than that of steam engines, although the initial cost is rather heavier.

Special precaution was taken for the propeller arrangement, for which outward turning screws were adopted and shaft brackets were fitted instead of the usual bossing in view of easier steering combined with an ample rudder area.

Main Engines

The main engines comprise two sets of Ikegai's single acting four cycle solid injection Diesel engines supplied by the Ikegai Iron Works of Tokyo. The particulars are as follows :—

Type.	*Ikegai 6SD40.*
No. of cylinders	6
Bore	400 mm.
Stroke	600 mm.
R. P. M.	220
B. H. P. normal	600 each
Total length	6,720 mm.
Width	1,810 mm.
Height	3,770 mm.
Weight	43 tons.

Fuel oil is injected to cylinders by automatic airless injection valves. Fuel pumps are fitted to the front of each cylinder and are directly driven by cams, specially arranged for the fuel pumps. The injection oil quantity is regulated by spill valves in accordance with power required. In order to prevent the excessive initial combustion pressure in the cylinders, a fuel injection timing arrangement is provided.

A governor is connected to the wheel shaft driving cams and controls the spill valves of the fuel pumps. In order to prevent the choking of the nozzles as well as to minimize the wearing of sliding parts, oil filters of 120 meshes, a Sharples oil purifier of 120 gallons, a two tons oil fuel heating tank, a 1.6 ton fuel oil cleaning tank, and a transfer pump are provided. Further, two four tons oil settling tanks with heating steam pipes (one of them being for ready use) being provided, fairly purified oil can be supplied to the engines, even if the oil purifier is broken down.

The starting air pressure is 25 kgs. reduced from 42 kgs. which is stored in two large air reservoirs for each engine. Starting air can be conveniently delivered to either three cylinders or to six cylinders, while the starting operation can be carried out up to the pressure of 10 kgs.

The turning of the engines being done by worm gears driven by servo-motors, the operation is entirely noiseless and smooth, besides special safety devices are fitted to the system.

The engines are lubricated by a forced system. Oil dropped in the crank chambers is collected to two oil wells of two tons capacity in the double bottom and after being drawn by lubricating oil pumps, it is supplied to each moving part through oil coolers.

For the piston lubrication, two sets of Bosch visible forced lubricators are provided.

The cooling water pump and bilge pump are of double acting type, all having same dimensions and a capacity of 28,000 litres per hour at 220 r.p.m. The lubricating oil pump and sanitary pump are also of the same size with a capacity of 7,500 litres per hour.

In order to reduce the resistance of the propellers on sailing, craw clutches are provided between the main engines and thrust blocks to disconnect the propeller shafts from the engines. Band brakes are fitted to the intermediate shafts for the convenience of the clutch connection. The thrust bearings are of the Mitsubishi-Mitchel type.

The propellers are of solid manganese bronze and outward turning with a diameter of 7'-6", pitch 6'-6", number of blades four, developed area 22.4 sq. ft. and a weight of 901.23 kgs.

Auxiliary Machinery

The following auxiliaries are installed in the engine room :—

One set of Ikegai 2SD22 type airless injection Diesel engines of 60 b.h.p. at 400 r.p.m. to which a 3,600 cub. ft. three stage air compressor and a 70 tons general service pump are directly coupled.

One set of Ikegai 24 h.p. gasoline engines, to which a 15 kw. D.C. dynamo and a 1,800 cub. ft. three stage air compressor are connected.

One set of oil burning Cochlan auxiliary boilers with a diam. 6-ft., height 15-ft., pressure 150 lb. and a heating surface of 444.7 sq. ft.

One set of steam driven generators of 105 volts.

Further, there are various auxiliaries driven by steam, including Worthington heavy oil transfer, ballast and fresh water pumps, Weir's feed water pump, evaporator, distiller, etc.

Exhaust steam from these auxiliaries is recovered by a condenser installed in the engine room and is fed again to the boiler after separating oil, or can be discharged to the atmosphere. The condensing plant comprises one set of Weir's atmospheric type contra-flow condensers with total cooling surface of 145 sq. ft. provided with an oil separator and a feed water filter.

As to the compressed air system, there are four starting air reservoirs of 50 cub. ft. at 42 atms. and one air reservoir of 70 cub. ft. for the 60 h.p. auxiliary Diesel engine. Not only two sets of three stage air compressors can replenish the air reservoirs, but also one power cylinder of each main engine and 60 h.p. auxiliary Diesel engine can be operated as a compressor whenever necessary. Further, a hand driven two stage air compressor is provided in order to enable the 70 cub. ft. air reservoir to be replenished.

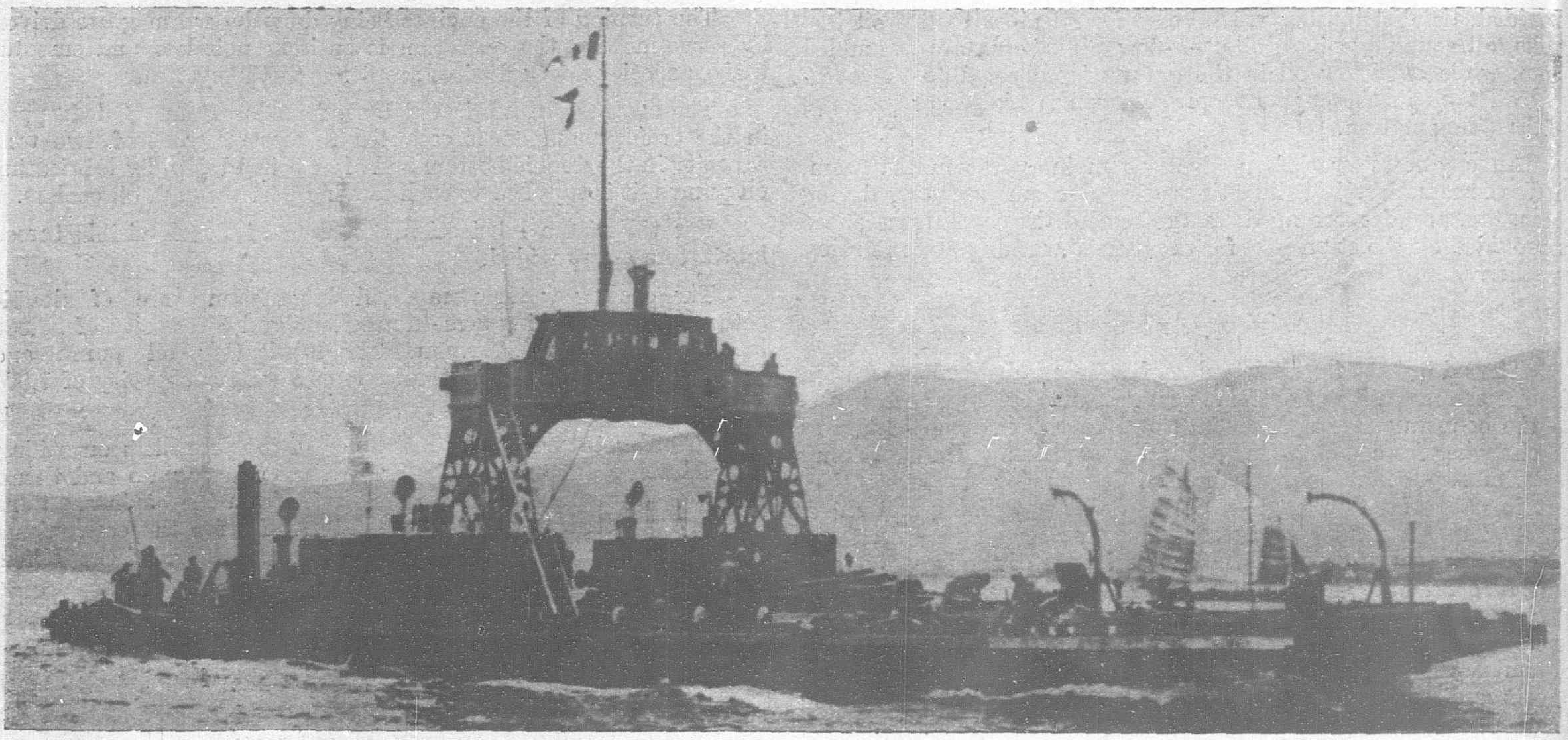
In starting the engines, air is reduced to 25 kgs., but the main engines can be mechanically reversed or started up to the air pressure of 15 kgs., while the starting only is possible even at 7 kgs. Compressed air is further reduced to 1 or 2 kgs. for a Tyfon whistle, sea water valve ejectors, starting burners of the auxiliary boiler and for cleaning of the engines when overhauled.

In the funnel, two silencers for the main engines, two silencers for the 60 h.p. and 24 h.p. auxiliary Diesel engines and a chimney for the boiler, cooking ovens, etc., are installed, whilst the top of the funnel is well protected from dashing sea water with special protected openings, which can be also utilized as ventilators and to prevent overheating of the funnel.

Official Trial Results of the "Nippon Maru"

The results of the official trials of the *Nippon Maru* at full power and at various loads are given in Tables I and II. On each trial, the draught of the ship was 15-ft. 9⅞-in.

(Continued on page 646)



The "Ukoh Maru No. 1" in service between Uno the Main Island and Takamatsu of Shikoku Island

Development of Ferry Boats by the Imperial Japanese Government Railways

By Y. TAJI, M.Eng., M.I.N.A., M.I.Mar.E.

SOME sixty years ago, the first railway of Japan was constructed between Tokyo and Yokohama with the aid of English railway-engineers, and about twenty years ago the principal railways of Japan were purchased by the Imperial Government under the Act for State Possession of Railways. Now, the whole railway system of Japan is under control of the Ministry of Railways, except a few local lines.

It would be astonishing to note the remarkable development of railways in this country, which first started with a distance of only 18 miles, and now has been extended over 15,000 miles despite various geographical difficulties of construction owing to numerous high mountains, deep valleys and rapid rivers.

The enormous increase of passengers and goods in conjunction with the development of railways has made it necessary to replace old ferry steamers and channel boats by new train ferries and better equipped vessels.

There are three main cross-channel routes in Japan proper, *i.e.* the northern passage between Aomori and Hakodate, the southern passage between Shimonoseki and Moji, and the Inland Sea passage between Uno and Takamatsu. The first two being on the main line running longitudinally through the Main Island, Hokkaido and Kyushu, are busiest on service.

Further, the cross-channel service between Shimonoseki and Fusan in Korea is a very important international route connecting the main island of Japan to the continent of Asia. The difference of railway track gauges, however, has rendered it impracticable to operate train ferries over this rough and long voyage.

There is also the Sakhalin-Hokkaido route operated by the Government Railways, on which a powerful ice breaker, the *Aniwa Maru* is employed for passengers and goods service.

The tremendous increase of goods on these routes during the last ten years is not only due to natural tendencies, but also is influenced by the improvement of equipment and service on land and sea.

The northern passage being for a long distance and over a rough sea, it has been impossible to construct a tunnel or to use any method of transportation other than the ferries.

The southern passage between Shimonoseki and Moji being very short in distance, the Government has already carried out a complete geological survey for building a tunnel, but the geological conditions and swift current in this strait necessitate the tremendous expenditure of over Y. 40,000,000 for the enterprise; consequently, this plan has now been practically abandoned by the Government in view of the financial difficulty. A private company has been planning to construct a suspension bridge over this strait, but the realization is very doubtful in view of the slight possibility of realizing profit from an investment of very large capital. Also it has a disadvantage from the viewpoint of national defence, as it could be easily destroyed by a single bomb from a hostile aircraft.

The Ministry of Railways has long been considering the adoption of Diesel train ferries on these routes, but it has been hampered from an economical viewpoint as the price of Diesel oil in these ports is very high while coal can be supplied at very low cost for the reason that the main coal-mining centers of Japan are near these ports. But the saving of machinery space, instantaneous starting, abolition of funnels and other factors of great value in the operation as well as in the arrangement of railway tracks on deck and saving of cargo space, have moved the authorities to decide to build a number of new Diesel train ferries in the near future.

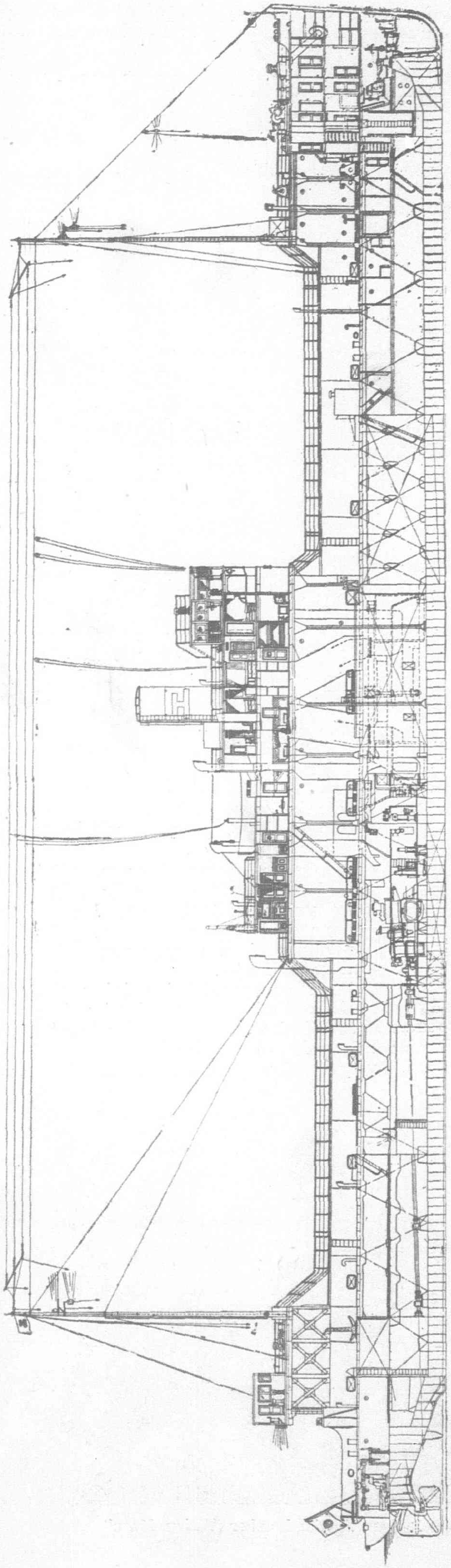
The relative merits of adopting Diesel passenger ships or steam turbiners for communication between the main island of Japan and Korea have been also very carefully surveyed by the Ministry of Railways, and it is reported that the adoption of Diesel ships has been finally decided upon.

(I.) The Northern Passage—The Train Ferry Turbiners "Matsumae Maru" and "Seikan Maru" Classes

In 1929, 876,501 passengers and 795,677 tons of goods were transported through this passage, and it is expected in this year that more than 1,000,000 tons of goods will be handled.

General arrangement of the "Aniwa Maru"

Showing general arrangement of the ice breaker, "Aniwa Maru"



Showing general arrangement of the "Seikan Maru No. 2"

There are six car ferries on service between Aomori and Hakodate, *i.e.* the *Shoho Maru, Hiran Maru, Tsugaru Maru, Matsumae Maru, Seikan Maru No. 1* and *Seikan Maru No. 2*. The last two ships are for carrying goods wagons only, whilst the others are for passengers as well as for cars and are of the same design and construction, except in types of the propelling machinery.

The *Matsumae Maru* and *Tsuruga Maru* were built in the Mitsubishi Nagasaki shipyards and are powered with the Mitsubishi all impulse single reduction steam turbines, whilst the *Shoho Maru* and *Hiran Maru* were built in the Uraga Dockyard and are propelled by Metropolitan-Vickers Rateau impulse single reduction turbines. The *Seikan Maru No. 1* and *No. 2* were particularly designed for carrying goods wagons only, the first was built in the Yokohama Dock Company and is propelled by two sets of Brown-Boveri's impulse reaction turbines with double reduction gears, whilst the second is the latest ship built in the Kawasaki Dockyard of Kobe installed with Kawasaki's all impulse single reduction geared turbines and is now on service between Aomori and Hakodate.

As to the *Shoho Maru* and her sister ships carrying passengers and cars, a full description having been given in the January issue of *The Far Eastern Review* this year, the writer gives herewith a brief description of the new goods wagon ferry *Seikan Maru No. 2.*

The dimensions and principal characteristics of the *Seikan Maru No.* 2 are as follows :—

Length over all		370′-0″
Length between perpendiculars		360′-0″
Breadth moulded		52′-0′
Depth moulded to wagon deck		20′-0″
Maximum draught		13′-0″
Displacement		3,875 tons.
Dead weight		959 tons.
Gross tonnage		2,493 tons.
Net tonnage		853 tons.
Shaft horse-power		2,485
Trial speed		13.93 knots.
Service speed		11 knots.
Number of passengers :		
First class	0	
Second class	0	
Third class	12	
Complement	54	
Total	66 persons.	

Number of cars :—43—15-ton wagons.

The cars are embarked on the wagon deck exposed fore and aft, which, being the strongest deck of the ship, extends continuously over the whole length of the ship, whilst all others are shorter.

The cellular double bottom extends also over the whole length and is utilized for the stowage of feed water, fresh water and ballast water. Special precautions have been taken for the strength and rigidity of the vessel, and the trussed system of construction has been adopted between the wagon deck and inner bottom together with necessary strong pillars.

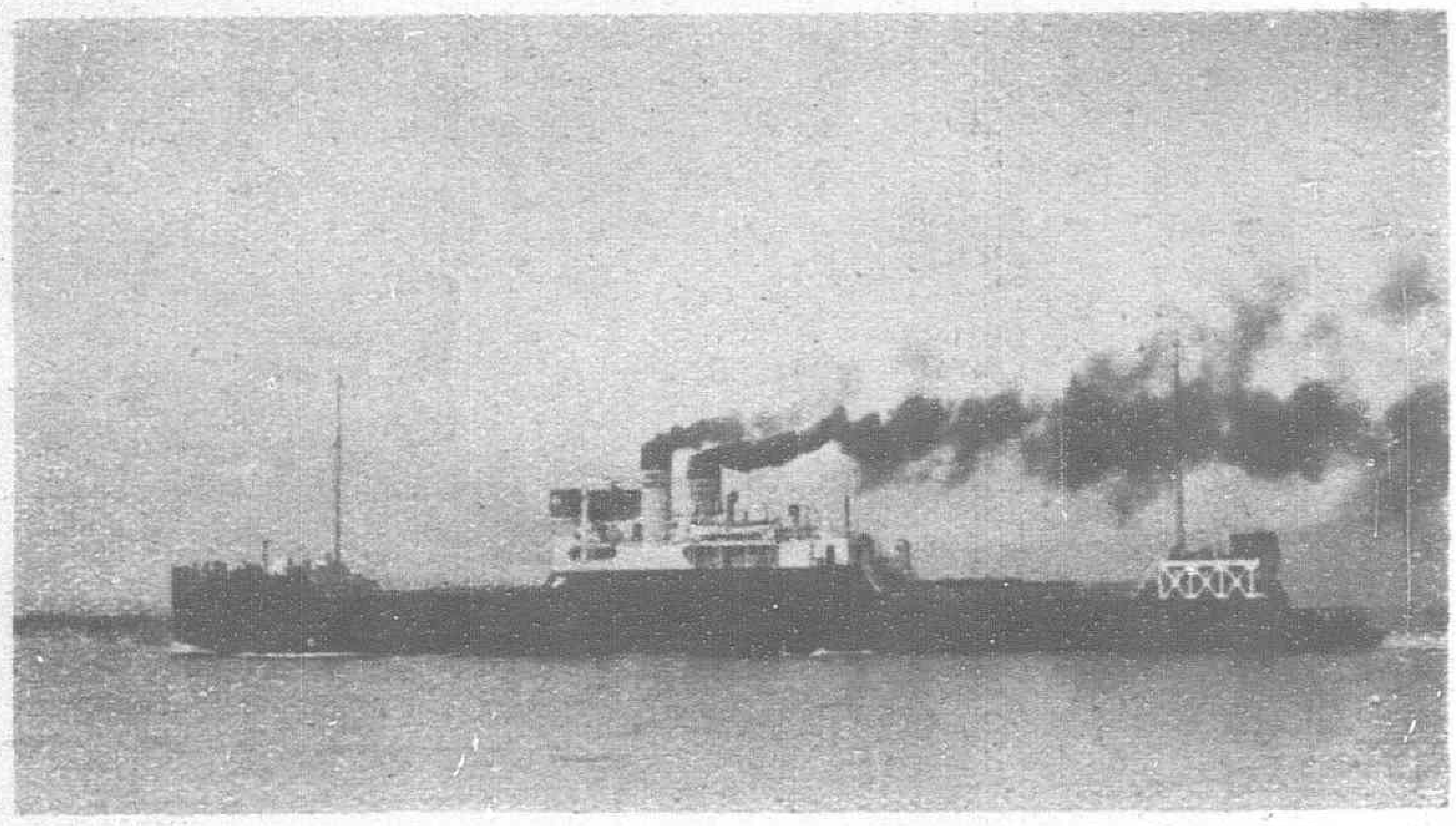
Wing tanks are provided at both sides of the ship in order to prevent the ship from heeling while the wagons are embarked on one side track, these are fitted with pneumacators and are connected to a powerful electric trimming pump in the engine room. Sea water can be admitted into any side tank as required and also can be shifted from one side to the other. These operations can be done by an electric controller at the after navigation bridge, where clinometers, pneumacator gauges, etc. are also provided.

The life-saving appliances comprise two 25-ft. life-boats and one 15-ft. Japanese junk (" Temma") on the boat deck and bridge deck.

The vessel has a well cut-up cruiser stern, a rectangular semi-balanced rudder and a special bow rudder in order to ensure easy and efficient manoeuvering of the ship, both the rudders being operated by steam steering gears controlled by telemotor system.

Various compasses, engine telegraphs, docking telegraph, loud speaking telephones, engine revolution indicators, etc., are provided on the navigation bridge. Further, complete equipment for wireless telegraphy and telephony, direction finder, sounding machine, fog apparatus, logs and all other necessary navigating and communicating appliances are fitted complete.

Special care has been given to the accommodation for officers and men, ventilation, heating and lighting of the ship to ensure the utmost comfort of ship's members and efficiency of the vessel.



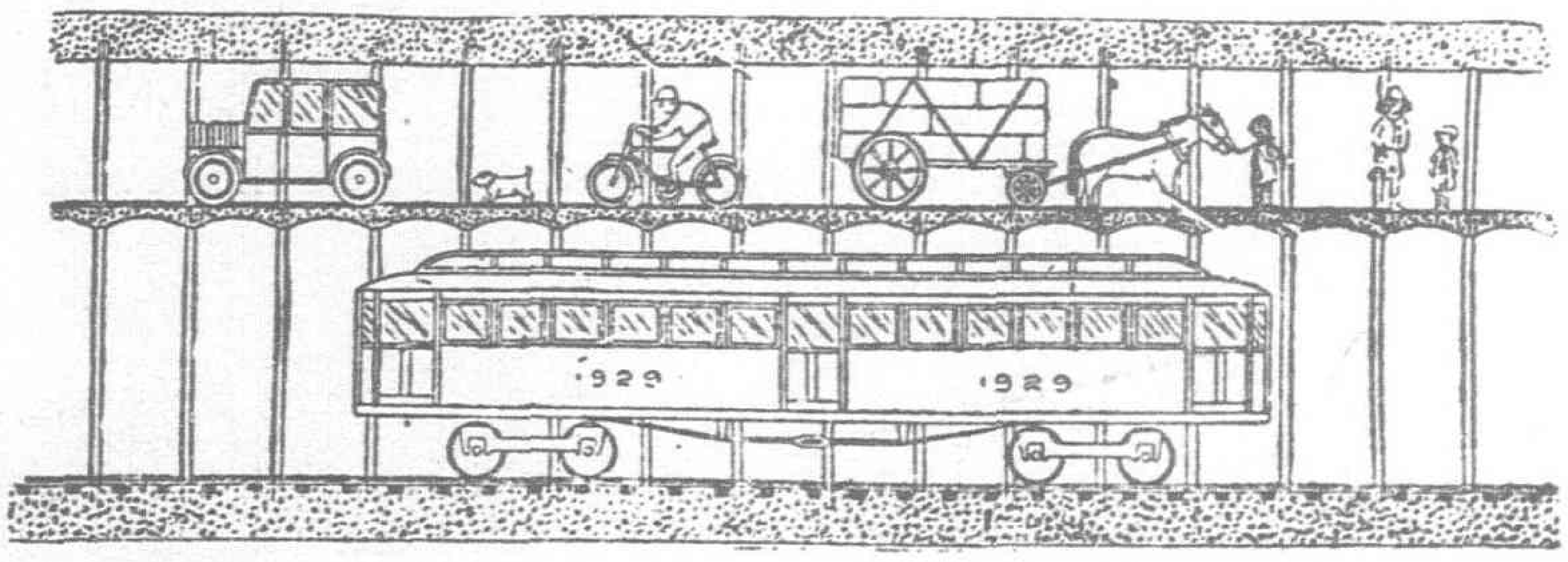
The car ferry "Seikan Maru No. 2"

The main propelling machinery comprises two sets single reduction geared turbines of all impulse type manufactured solely by the Kawasaki Dockyard, driving twin propeller shafts. Propellers are of manganese bronze four bladed type with a diameter of 9-ft. 10-in. and a pitch of 13-ft. 9-in.

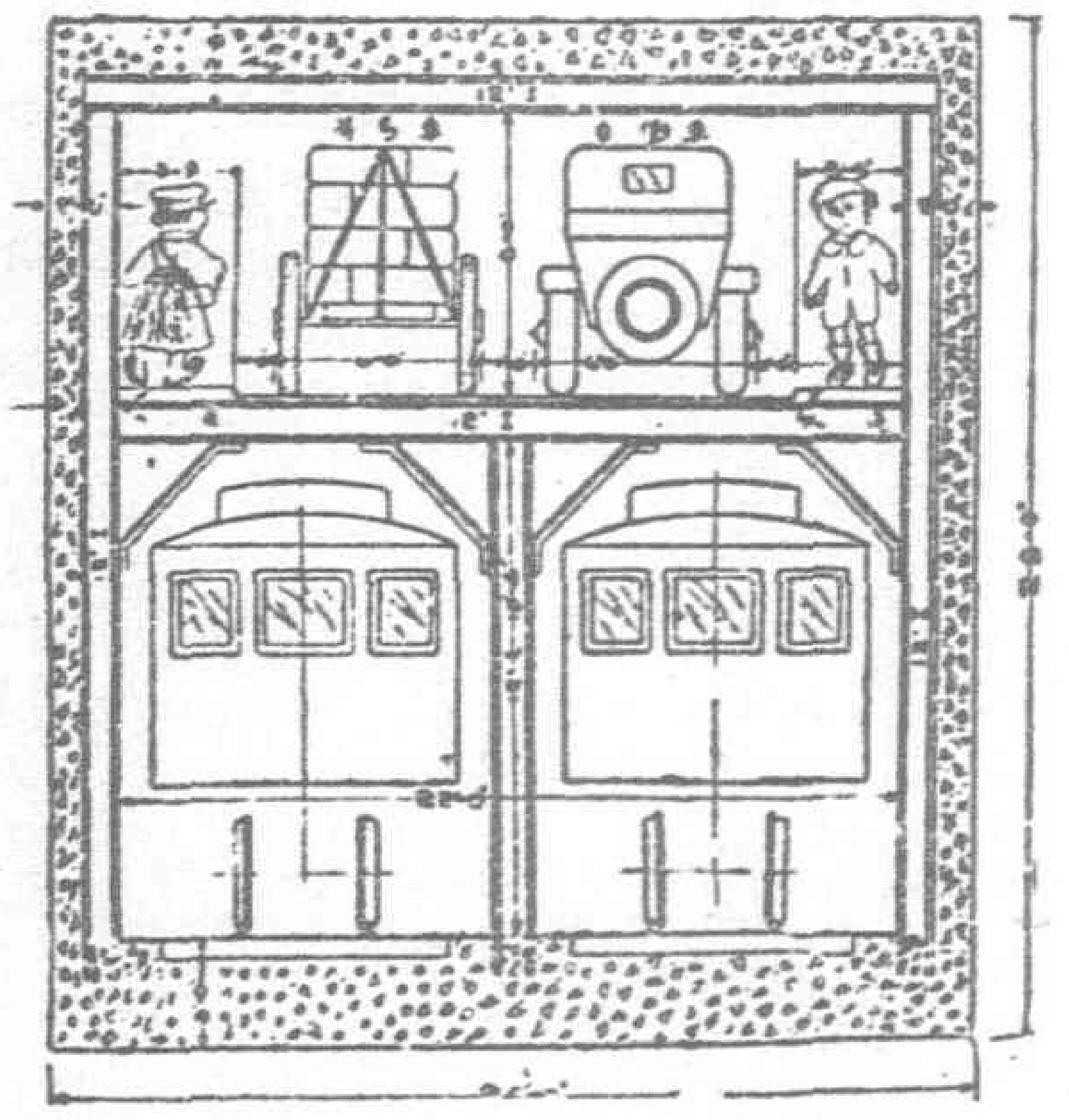
The steam generating plant consists of four sets of cylindrical marine boilers of a diameter 11-ft. 6-in. and a length of 11-ft. 6-in., the working pressure being 200 lb. per sq. in. superheated at 102 deg. F.

It should be noted that in the *Matsumae Maru* and *Tsugaru Maru* steam is supplied by Babcock and Wilcox water-tube boilers with superheaters and forced draught of the closed stokehold system, whilst the *Shoho Maru* and *Hiran Maru* are installed with single ended Scotch boilers with Schmit's superheaters and Howden's forced draught systems. The boilers of the *Seikan Maru No. 1* are of Ikeda's patent watertube type.

The quay walls and land equipment at Hakodate and Aomori are very interesting in their design and construction. A full description of these appeared in *The Far Eastern Review* of January, 1931.



Profile of proposed double tunnel under Kammon Strait



Cross section of tunnel

(II.) The Southern Passage—The "Kwanmon Maru" Class, Proposed Diesel Ferries and Private Enterprise for Tunnel Construction

This is the busiest route connecting the main island and Kyushu at Shimonoseki and Moji or Komoriye, whilst the distance to be crossed is the shortest of all passages. In 1929, the total number of passengers across this strait was 4,301,649 and goods transported 1,693,166 tons. It is expected that this year some 2,000,000 tons of goods will be handled. The rapid increase of goods during the last ten years is remarkable. It was about 1,100,000 tons in 1921, which increased to 1,700,000-2,000,000 tons, and if the same tendency continues in the coming ten years, the volume of goods should become nearly 3,000,000 tons in 1941.

In view of the frequent passenger service across this channel, passengers are carried by small ferry steamers plying every 20 to 30 minutes, while goods are transported by car ferries plying 59 times between the Shimonoseki quay and Komoriye depôt near Moji, which make the operation by day and night, and often cause serious complaints of obstruction for large vessels passing through the strait to and from the Sea of Japan.

The fundamental remedy in handling the overwhelming traffic would be the construction of an under-water tunnel or a very high bridge of an enormously long span, but the Government's scheme for the tunnel has been stopped by financial difficulty, whilst the latter has a disadvantage from the national defence view, as mentioned already. Consequently, the present scheme is to build several car ferries of larger capacity with at least three tracks on deck.

The boats under operation are car ferries of the *Kwanmon Maru* class of the following particulars :—

THE "KWANMON MARU NO. 5."

Length over all	183'-0"
Length between perpendiculars	176'-0"
Breadth moulded	30'-0"
Depth moulded	14'-0"
Load draught	7'-10½"
Gross tonnage	502.28 tons.
Registered tonnage	179.62 tons.
Displacement	745.00 tons.
Dead weight capacity	188.00 tons.
Coal bunker capacity	30.00 tons.
Fresh water	20.00 tons.

Engines :—Two sets of compound steam engines.

Boilers :—Two sets of cylindrical marine boilers.

Propellers :—Two paddle wheels.

Trial speed :—10.45 knots.

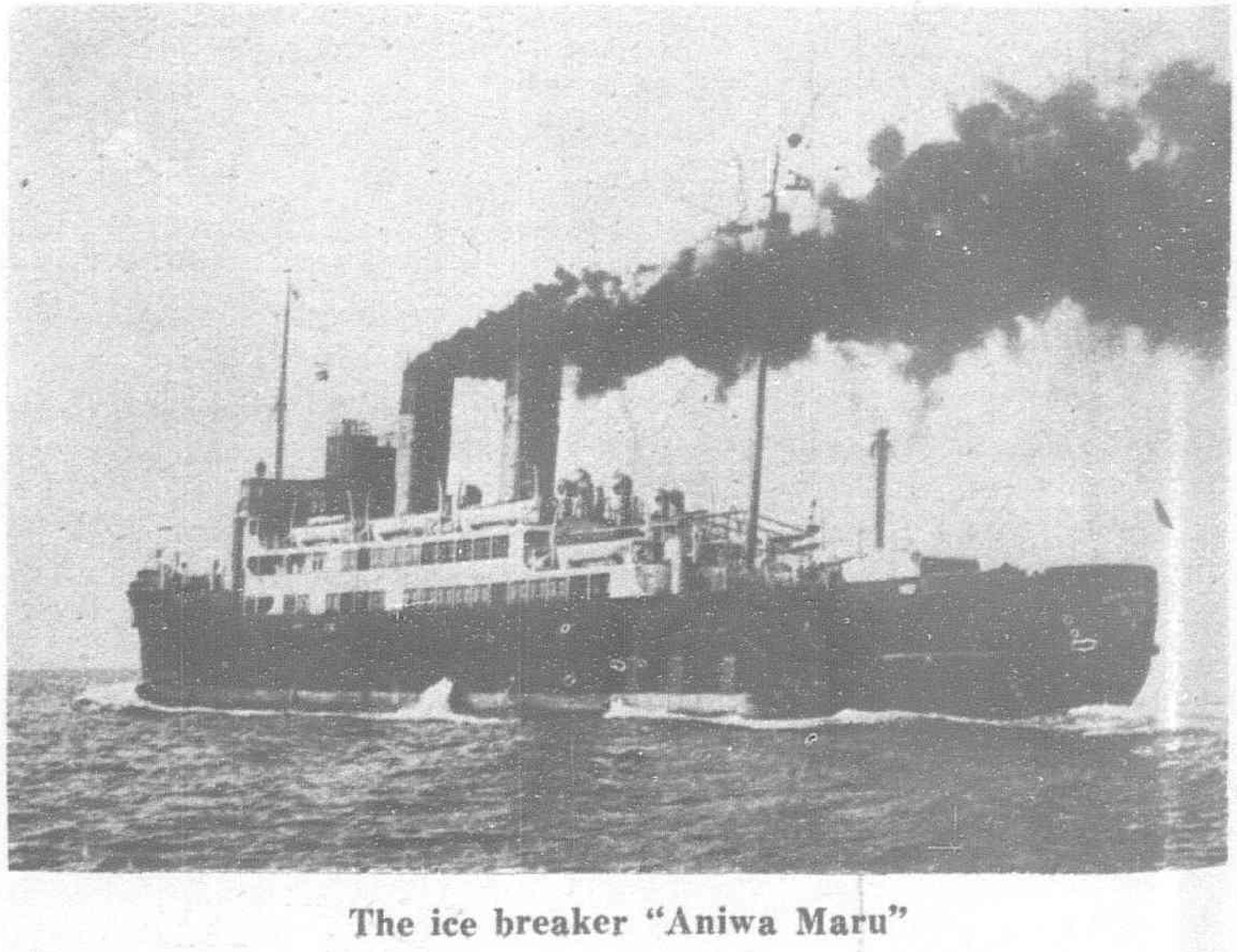
Indicated horse-power :—391.

The vessel is symmetrical to amidships and has a single wagon deck of a diamond shape provided with a single track, a wheel-house on a truss work amidships, funnels at sides near amidships, bow and stern rudders and steering gears. When the boat is in the landing dock, nearly one half length of the ship is embraced by the side-walls.

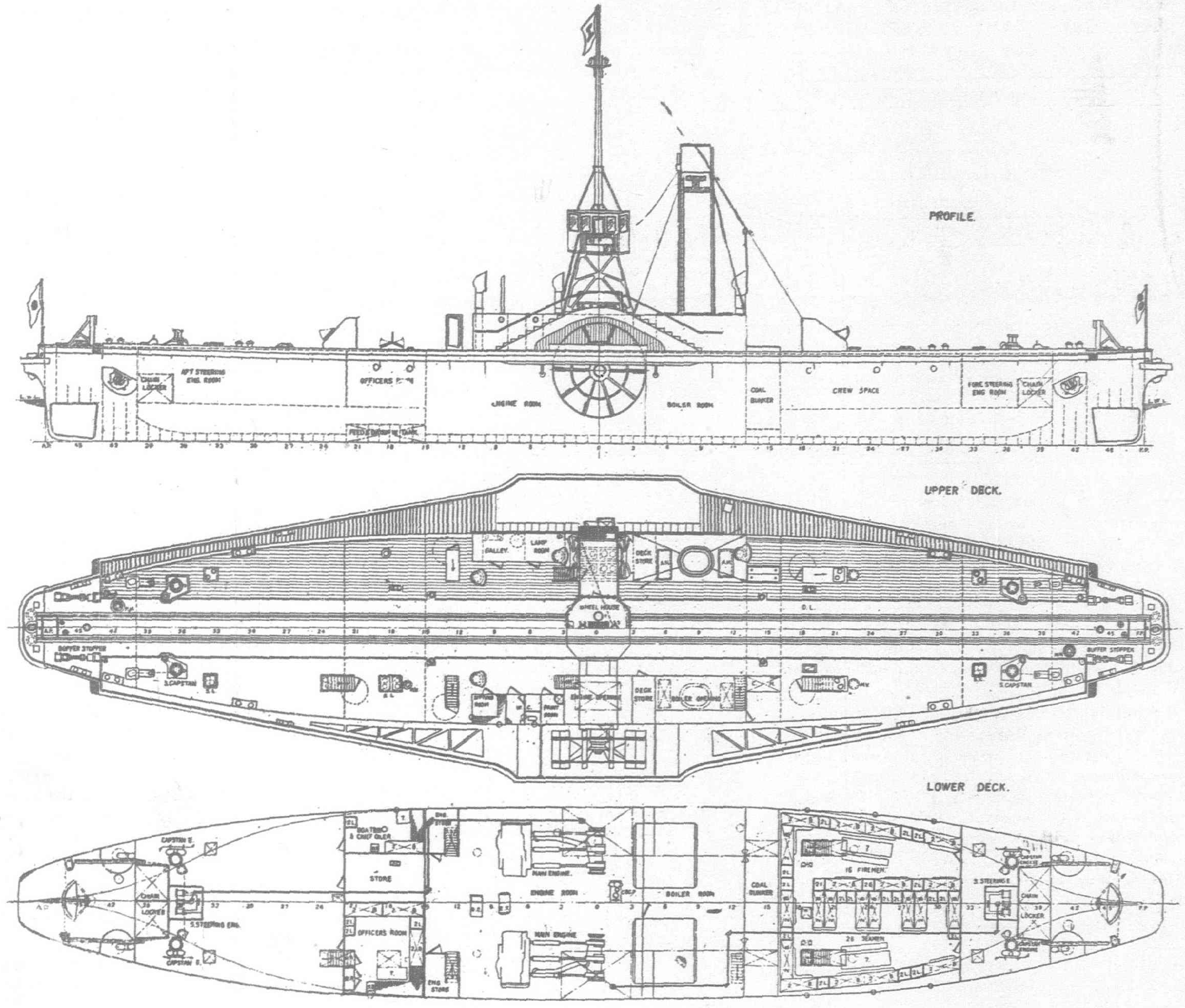
The idea of the adoption of paddle wheels is due to the difficulty in manoeuvering the ships under screw propulsion in very strong currents near the landing on the Shimonoseki side. Details of the arrangement will be seen in the accompanying plan.

On the Japanese Government Railways, one goods train consists generally of forty to forty-five wagons of 15 tons capacity, so that about two and a half hours are necessary for the transportation of all wagons across the strait by these car ferries.

The proposed design of the new car ferries is for Diesel engined ships of a larger type following the example of the *Ukoh Maru No. 1* built for the Inland Sea service. These vessels would have a length of about 210 feet, a gross tonnage of about 800 tons and a very broad wagon deck with three lines of railway



The ice breaker "Aniwa Maru"



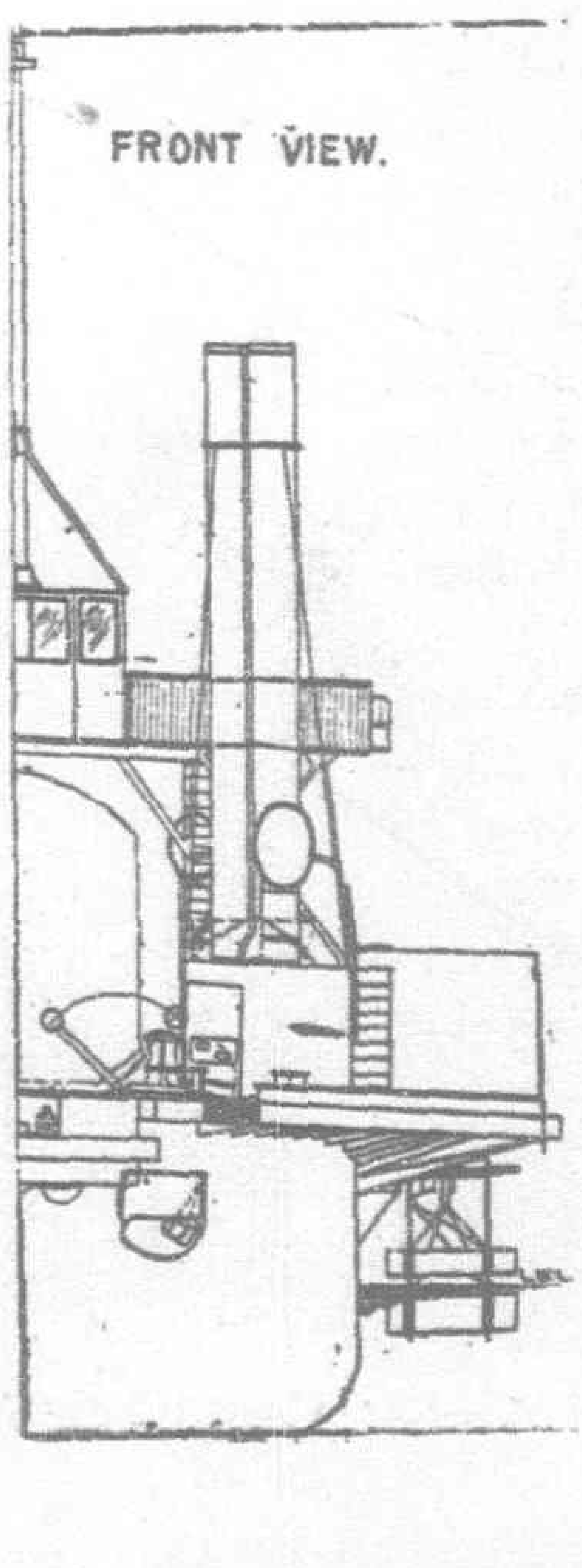
tracks. The difficulty of swift currents near the docks will be materially overcome by the completion of the projection of concrete walls, which enables the usual screw propulsion to be available.

It is interesting to note that recently a fundamentally different enterprise for construction of a tunnel between Shimonoseki and Moji has been planned by private promoters, and the scheme was submitted to the Ministry of Railways for approval.

This is an alternative plan to that of the Government, which was abandoned in February this year after having spent over Y.800,000 for the geological survey. In this latest proposal for an under-sea tunnel, the distance to be crossed is about 3.2 miles and the tunnel includes upper and lower parts. The upper consists of side pavements for pedestrians and a central driveway for general traffic, while in the lower part electric tram lines will be constructed, on which eight tram bogies of large size will run.

This plan appears rather eccentric, yet it is said that it is well supported by the two cities of Shimonoseki and Moji, as it will enhance their future development and prosperity besides being a great convenience to travellers and citizens.

The estimated cost of construction is about Y.18,000,000 or about Y. 4,200,000 per mile including all costs for the completion and operation, while the original Government estimate for the railway tunnel was over Y.40,000,000.



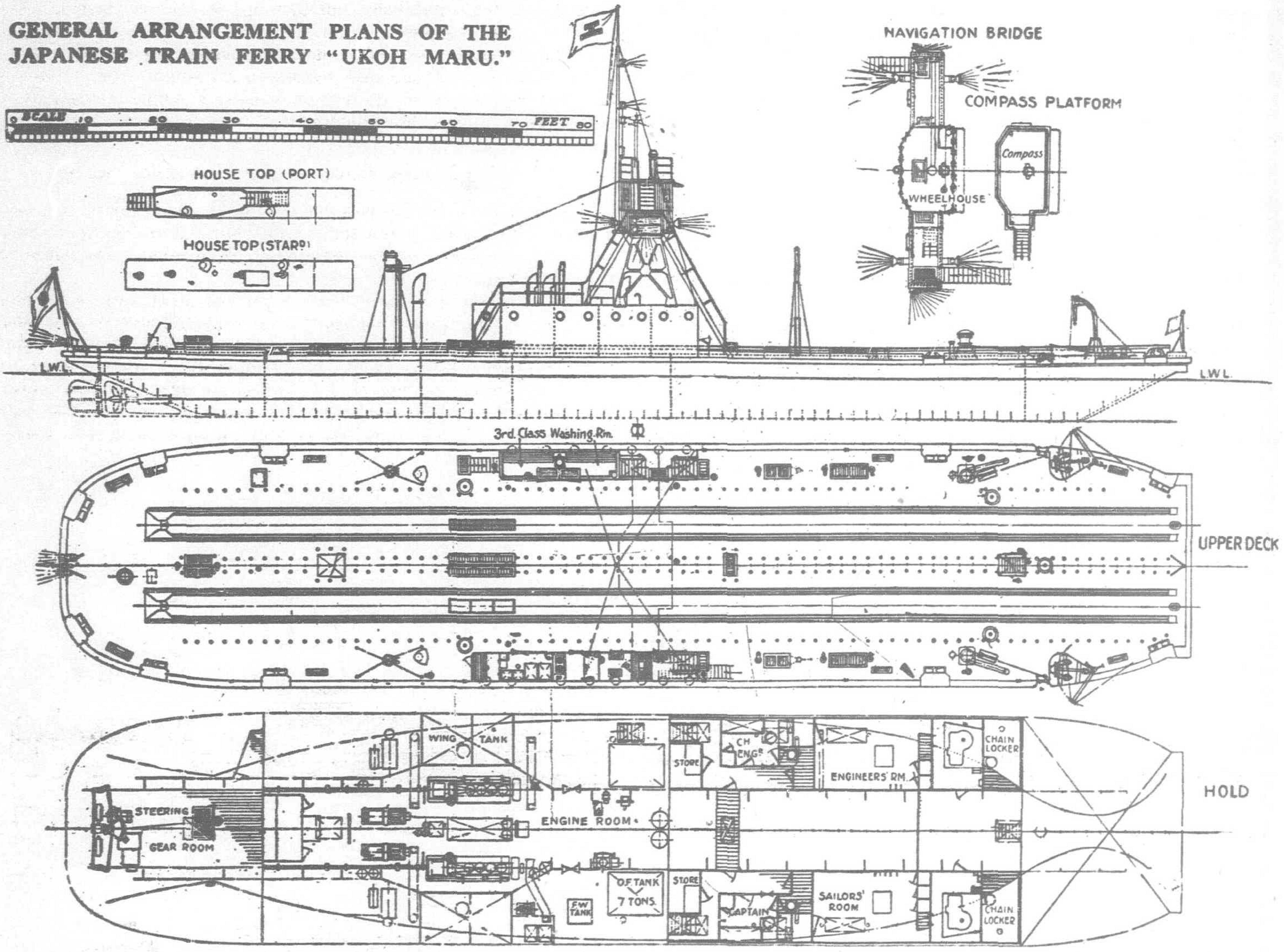
If the plan be approved by the Ministry of Railways, the sponsors of the project would establish a company and would complete the tunnel within two years. Its realization, however, appears rather doubtful.

(III.) The Inland Sea Passage—The "Ukoh Maru No. 1"

This route resembles somewhat the passage between England and Ireland, though the distance is much shorter and the sea is calmer in Japanese waters.

Ferry boats are operated between Uno of the main island and Takamatsu of Shikoku Island. The total number of passengers transported over this route in 1929 was 768,161, while goods carried was 144,298 tons.

Passengers are at present carried by two turbiners of 562 gross tons as well as by several smaller vessels, while goods were transported by car barges towed by steam tugs until the new car motor ferry *Ukoh Maru No. 1* was put in service.



GENERAL ARRANGEMENT PLANS OF THE JAPANESE TRAIN FERRY "UKOH MARU."

THE "UKOH MARU No. 1."—The vessel is the first Diesel car ferry in Japan and has been built more or less for experimental purposes. The leading particulars are as follows:—

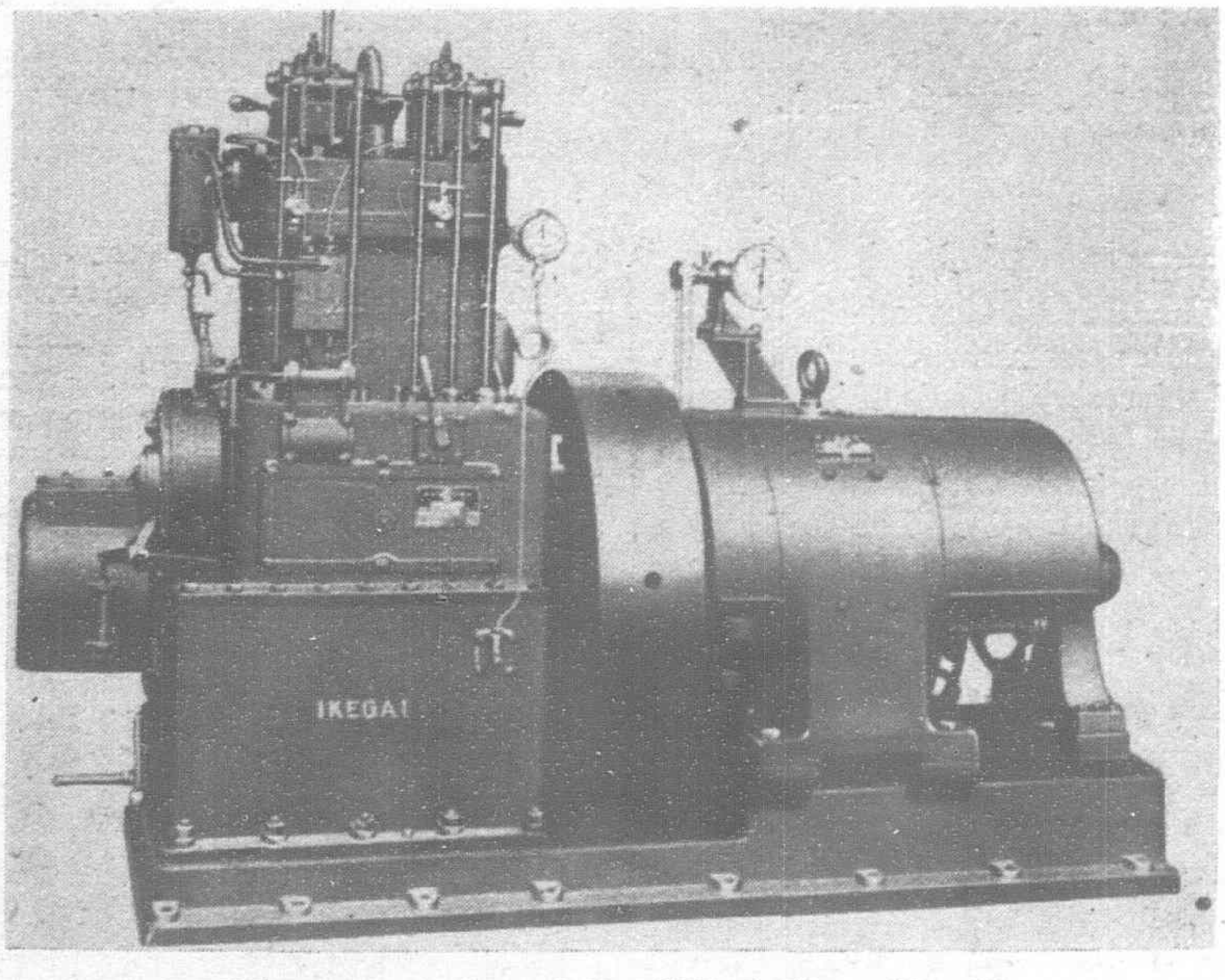
Length over all	157′-6″
Length between perps.	150′-0″
Breadth moulded	32′-0″
Depth moulded	8′-6″
Draught	5′-6″
Gross tonnage ...	312.68 tons.

Propelling machinery:—
Two sets of Ikegai airless injection Diesel engines.

Normal output:—300 b.h.p.
Trial speed:—8.7 knots.

The vessel has a single wagon deck unusually broad where two lines of railway tracks are arranged, each being loaded with six carriages.

In view of carrying heavy loads special construction has been adopted in the hull structure. Extending the whole length of the ship, trussed structures are arranged under the railway tracks, except in the machinery room. The stern is made very broad with strong beams in order to fit twin rectangular rudders, for which a Hele-Shaw hydraulic-electric steering gear is provided.



Diesel generator of the "Ukoh Maru No. 1"

The navigation bridge is very high on the braced girder work extending over the wagon deck amidships to allow the carriages to pass through underneath and there is a small mast at the center line aft.

The propelling engines are of the Ikegai four cycle single acting airless injection type, each having four cylinders with a bore of 240 mm. and a stroke of 380 mm. with an output of 150-170 b.h.p. at 360-400 r.p.m. and a fuel consumption of 180 grams per b.h.p. per hour for all purposes. A mean trial speed of 8.7 knots was obtained at the official trial, when the mean power was 388 i.h.p. at 381 r.p.m.

(IV.) The Continental Passage—The "Keifuku Maru" Class

The passage across the Korean Strait between Shimonoseki and Fusan is a very important international route for communication between Japan and the Asiatic Continent, thence to Europe *via* the Siberian Railway. The total number of passengers over this route in 1929 was 729,243 and goods transported, 209,945 tons.

The distance to be crossed being over 120 miles and sea being generally rough with swift currents, the operation of fairly large and fast boats is necessary. At present, three fine turbine steamers of the *Keifuku Maru* class of the following particulars and two older steamers of about 3,000 gross tons are on operation.

THE T.S.S. "KEIFUKU MARU."

Length over all	375′-0″
Length b.p.	360′-0″
Breadth moulded	46′-0″
Depth moulded	28′-0″
Load draught	15′-0″
Gross tonnage	3,620 tons.
Displacement	3,892 tons.
Dead weight capacity...	690 tons.

Propelling machinery :—Two sets of Parsons geared steam turbines.

Boilers :—Eight cylindrical marine boilers.

Propellers :—Two sets of four bladed detachable type.

Trial speed :—19.8 knots.

Trial shaft horse-power :—8,514.

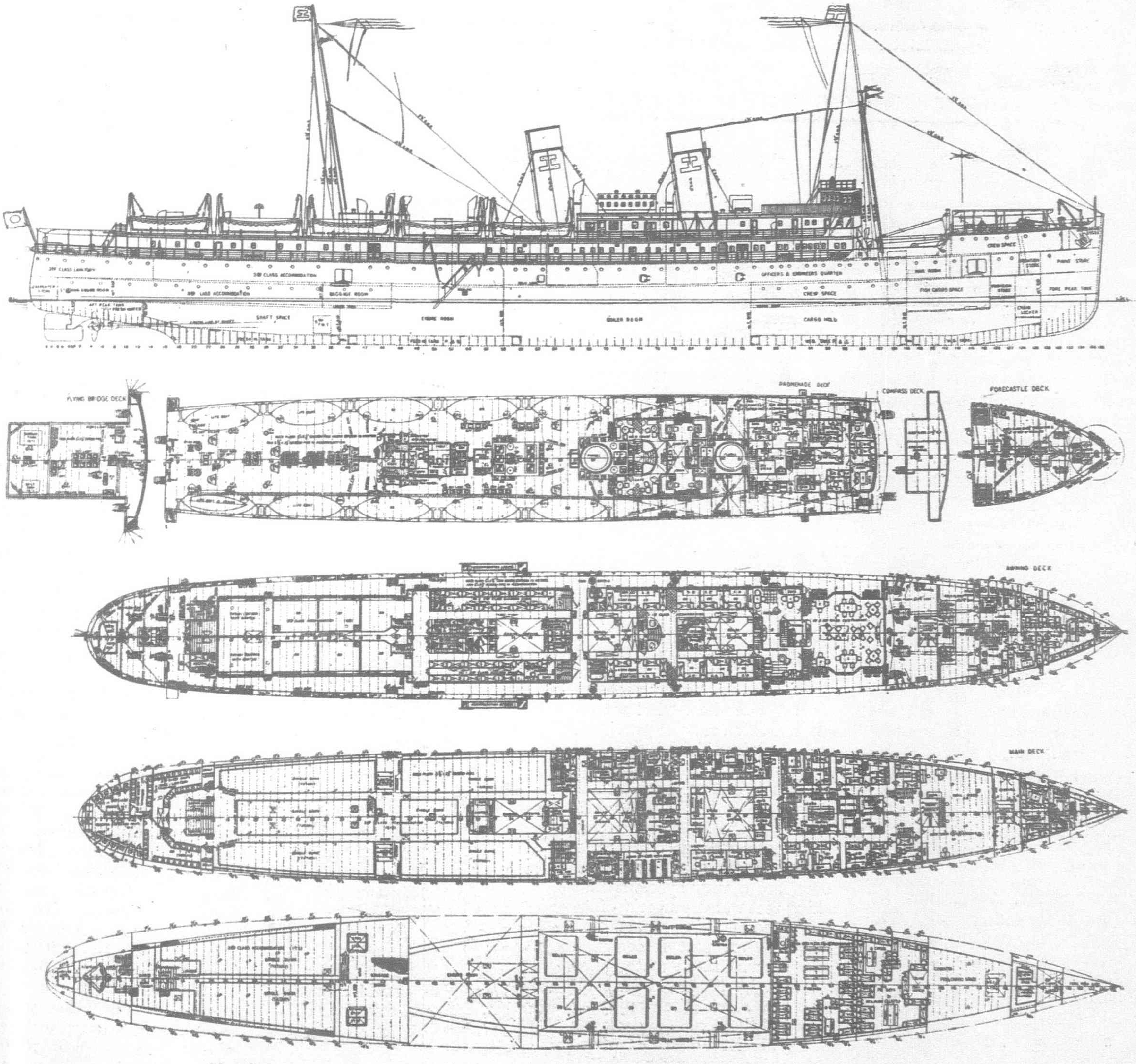
The vessels are richly decorated and very comfortably equipped for passengers and ship's members. One of these vessels is fitted with Motora's fin stabilizer, but it is not in use at present except in very rough weather.

The authorities are also considering the improvement of service on this line by building new motorships of some 5,500 gross tons, and the realization of these new vessels is only delayed by the present serious financial difficulty.

(V.) Sakhalin Route—S.S. "Aniwa Maru"

Attention is also to be given to the extreme northern passage between Wakkanai, Hokkaido, and Odomari on Sakhalin Island which is operated by the Japanese Government Railways, the distance being about 90 miles.

The ice breaker *Aniwa Maru* is serving on this route. The sea being frozen in winter, navigation is very difficult in this season through dense fogs and snow storms. Last year, it was recorded that the *Aniwa Maru* proceeded through the frozen sea breaking out ice more than ten feet thick. She is not only the most powerful ice breaker in the Orient, but also carries a considerable number of passengers, so many as 754 persons in total, and is a specially



Showing arrangement of T.S.S. "Keifuku Maru," "Tokuju Maru" and "Shokei Maru" well-accommodated cross-channel steamer. A brief description of this vessel will be of interest to readers.

The principal particulars and characteristics of the *s.s. Aniwa Maru* are as follows :—

Length over all	327′-4½″
Length b.p.	310′-0″
Breadth moulded	45′-0″
Depth moulded	30′-0″
Draught maximum	20′-11⅝″
Corresponding displacement	5,234 tons.
Gross tonnage	3,356 tons.
Net tonnage	1,524 tons.
Cargo capacity...	47,916 cub. ft. in bale.
Number of passengers :—	
1st class	18
2nd class	102
3rd class	634
Total	754

Complement :—87.

Engines :—Two sets of triple expansion engines.

Trial speed :—16.41 knots.

Horse-power :—6,395 i.h.p.

Service speed :—12 knots.

The vessel has a wedge shaped stem raked about 25 degrees to the water line for cutting ice, a cruiser stern, well protected rectangular rudder and twin propellers, two large funnels, two pole masts, three derrick posts, etc., and her appearance is quite impressive.

In order to ensure the safety of the ship in case of flooding, the hull is subdivided into nine watertight compartments by eight transverse bulkheads, *i.e.* a fore peak tank for salt water, Nos. 1 and 2 cargo holds, fore and aft boiler rooms, an engine room, No. 3 cargo hold, aft deep tanks and stern peak tank, etc. Bilging the fore and aft peak tanks is often necessary in ice cutting operations.

A considerable quantity of cargo can be carried, which is handled by two 3-ton derricks fitted to the forward twin posts and by one 3-ton derrick at the aft center line derrick post, for which three electric winches are provided. There are an electric windlass and an electric capstan on the forecastle deck, and one electric capstan at the upper deck stern. All deck machinery is electrically driven, as the ordinary steam driven machinery has often caused serious trouble in severe winters owing to the freezing of condensate and a great thermal loss in pipings.

On the boat deck, six 25-ft. life-boats are stowed at sides, and one 25-ft. motor life-boat, one ordinary life-boat and one 25-ft. " temma " are arranged on the promenade deck aft, all the boats being handled by Welin quadrant davits with electric boat winches.

On the front part of the boat deck are the captain's room and chief officer's room, above which a navigation bridge, a watch platform and compass platform are arranged. All necessary navigation and communication appliances such as compasses, engine telegraphs, steering and docking telegraphs, revolution indicators, navy 'phones, telephones, speaking pipes, etc. are fitted on the navigation bridge, while on the watch platform are a watch-house, a range finder, search light projectors, etc., these being very necessary for the navigation of northern seas. A complete wireless apparatus, sounding machine, fog signals, logs, etc., are also provided.

The foremost part of the promenade deck is utilized for officers' cabins, wireless telegraphy office and operators' room, emergency dynamo room, etc. The first class lounge is arranged amidships, which is easily accessible to the entrance hall below through a grand staircase. All first class state rooms are arranged on the aft part of the promenade deck at sides with every convenience.

The upper deck is mainly for the second class passengers' accommodation. On the forward part, are a very spacious first and second class dining-saloon, smoking-room and purser's office under the promenade deck. The second class sleeping rooms, etc., are arranged amidships at sides, whilst the aft part is occupied by a large second class Japanese room fitted with many rectangular side windows ; carpets being laid on " tatami," the passengers can sit or lie down after their custom, at the same time enjoying pleasing scenery on the voyage. Beyond the exposed deck for cargo handling, the forecastle is utilized for sailors' quarters, where sleeping compartments, petty officers' cabins, mess-rooms, baths and lavatories are arranged.

Third class passengers' accommodation is provided on the second and third decks. A forward half of the second deck from amidships is for firemen's and oilers' quarters, engineer officers' rooms, clerks' rooms, senior and junior officers' mess-rooms, ship's galley, baths, lavatories, etc. On the second and third decks abaft amidships are extraordinarily spacious Japanese rooms for the third class passengers, the rooms being laid with " tatami " and well opened to both sides of the ship. Baths and lavatories are arranged sternwards. Boys' and stewards' compartments are on the forward third deck and a steering engine room at stern.

It should not be overlooked that special care is taken for heating, ventilation and lighting of the ship, particularly in the living quarters, in order to meet special climatic conditions on this route.

Propelling machinery comprises two sets of triple expansion steam engines with cylinder diameters 21-in., 35-in. and 58-in. and a stroke of 42-in., the total output being 6,375 i.h.p. During ice breaking operations, the vessel is very frequently obliged to put the engines astern or ahead in conjunction with pitching motions of the ship, for such purposes reciprocating steam engines are yet considered as the most suitable.

Each boiler room has two cylindrical marine boilers of a diam. 15-ft. 9-in. and a length of 11-ft. 6-in. Cross bunkers are arranged between two boiler rooms and side bunkers to each boiler room, while a narrow passage is provided between them.

Propellers are of four bladed cast steel with a diameter of 12-ft. 6-in. and a pitch of 16-ft. 9-in. and are well protected from breaking down by striking ice.

Very recently, the Ministry of Railways decided to build another ice breaking passenger boat of about 3,200 gross tons following after the success of the *Aniwa Maru*, and tenders have been already invited from leading shipyards of Japan. It is expected that serious competition will take place amongst the shipbuilders under the present merciless depression in this industry.

The "Nippon Maru" and "Kaiwo Maru"

(Continued from page 639).

TABLE I. FULL POWER TRIALS.

Run.	*Engine.*	*R.P.M.*	*S.H.P*	*Speed (knots)*
I	Port	213	664	11.939
	Starboard	214	635	
II	P.	222	628	11.200
	S.	212	618	
III	P.	208	581	11.815
	S.	210	575	
IV	P.	209	640	10.994
	S.	210	604	
V	P.	210	622	11.802
	S.	210	602	
VI	P.	208	632	10.922
	S.	210	587	
Mean		210.5	615.7	11.445

TABLE II.

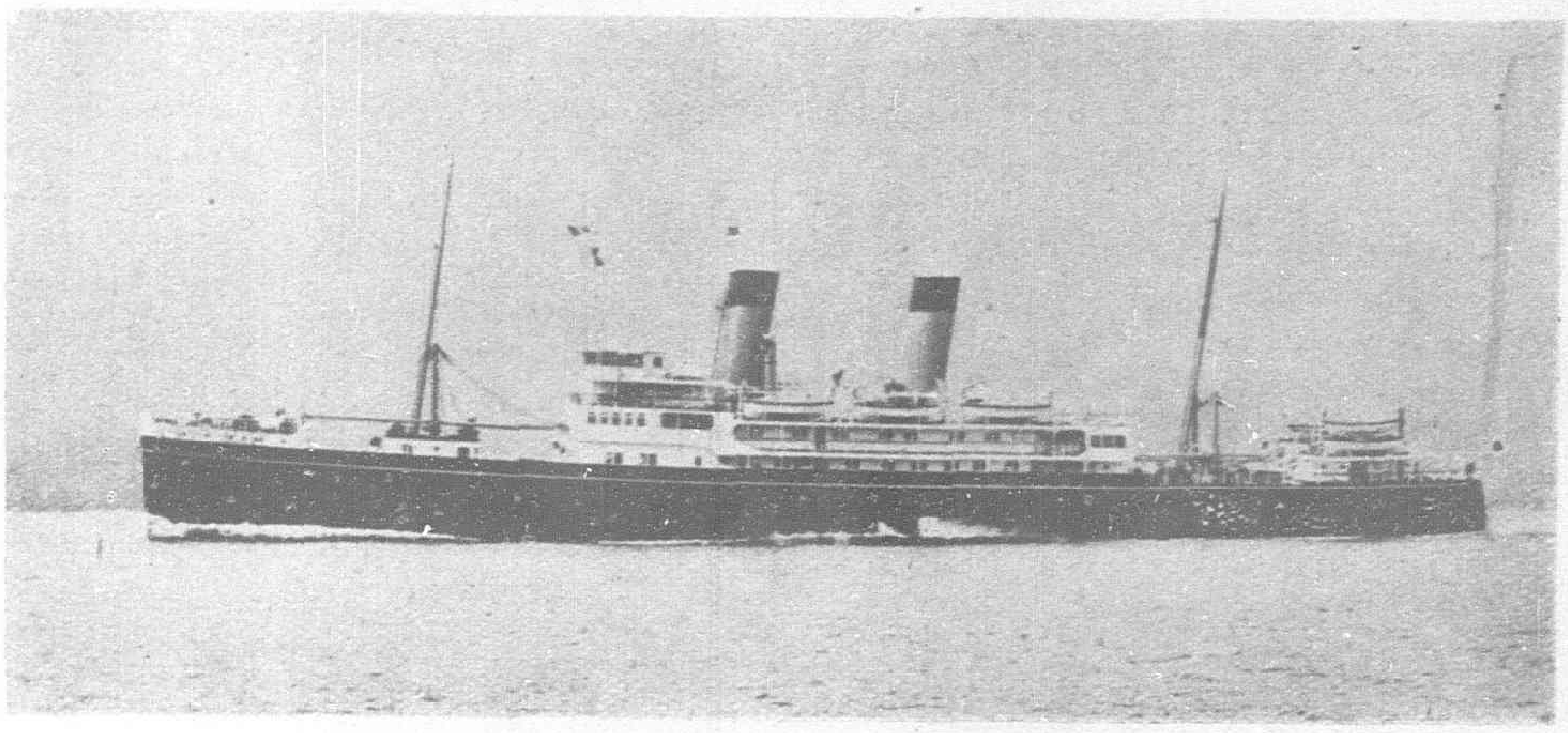
Load	*Engine*	*R.P.M.*	*S.H.P.*	*Speed (knots)*	
3/4	Port	190	500	10.077	10.408
	Starboard	189	490		
3/4	P.	191	481	10.739	
	S.	191	473		
1/2	P.	169	366	8.932	9.185
	S.	170	344		
1/2	P.	170	337	9.438	
	S.	172	329		
1/4	P.	136	179	7.355	7.512
	S.	138	169		
1/4	P.	138	179	7.668	
	S.	139	164		
11/10	P.	217	725	11.500	11.668
	S.	219	730		
11/10	P.	220	682	11.831	
	S.	221	650		

The New Turbine Liner "Choshun Maru"

For Dairen-Shanghai Service

Mitsubishi Impulse-Reaction Turbines. Considerable Improvement in Steam Consumption.

By Our Special Correspondent



The "Choshun Maru" on trial

THE *Choshun Maru* was built and engined in the Mitsubishi Kobe Dockyard to the order of the Dairen Kisen Kaisha, Ltd., and is the most up-to-date turbine passenger ship on the Dairen-Shanghai Service.

PRINCIPAL PARTICULARS

Length over all	375-ft. 6-in.
Length between perpendiculars	360-ft. 0-in.
Breadth extreme	46-ft. 0-in.
Depth to upper deck	28-ft. 6-in.
Gross tonnage	4,026 tons.
Dead weight capacity	2,086 tons.
Speed	17.25 knots.
Propelling machinery	Two sets of Mitsubishi Impulse-reaction type steam turbines.
Total shaft horse power	4,500
Propellers	Two sets of aero-foil type.

Number of passengers :—

1st. class passengers	84
2nd. class passengers	27
3rd. class passengers	220
Total	331
Complement	128

General Arrangement

The vessel is a super-structure vessel with two complete decks and a cruiser stern, the cellular double bottom being extended between the collision bulkhead and the aft peak tank bulkhead, subdivided into six water tanks. There are seven watertight bulkheads which subdivide the vessel into nine watertight compartments comprising four cargo holds, a peak tank, a cross bunker, a boiler room, an engine room and a steering engine room.

The vessel has two masts and two funnels arranged amidships, the funnel on the top of the engine room is a dummy, utilized for the ventilation and lighting of the engine room.

On the upper deck amidships, the first class dining-saloon and state rooms, second class state rooms and dining-room as well as a smoke-room are arranged. Above this deck is the promenade deck, where the entrance hall, the suite de luxe, first class state rooms, first class smoking-room and a verandah cafe are arranged. On the boat deck which covers the promenade deck, six life-boats with Welin's patent boat davits are provided at sides. Behind the dummy funnel is a wireless telegraphy room and on the forward part of this deck are officers' cabins, whilst the forecastle is arranged for boatswain's room, quarter-masters' room, mess, etc.

On the aft part of the upper deck are the third class dining-room and galleys, the top of which is utilized for the docking bridge where two life-boats, one gig and one "Temma" are provided, these being handled by Welin's patent davits.

The aft part of the second deck is for the third class accommodation with lavatories, bath, etc. The middle part of this deck is for engineer's cabins, a doctors' room, petty officers' cabins, offices, mess-rooms, a barber's shop, provision stores, cold chamber, etc. Crew's compartments are arranged on the forward part of this deck.

Passenger Accommodation

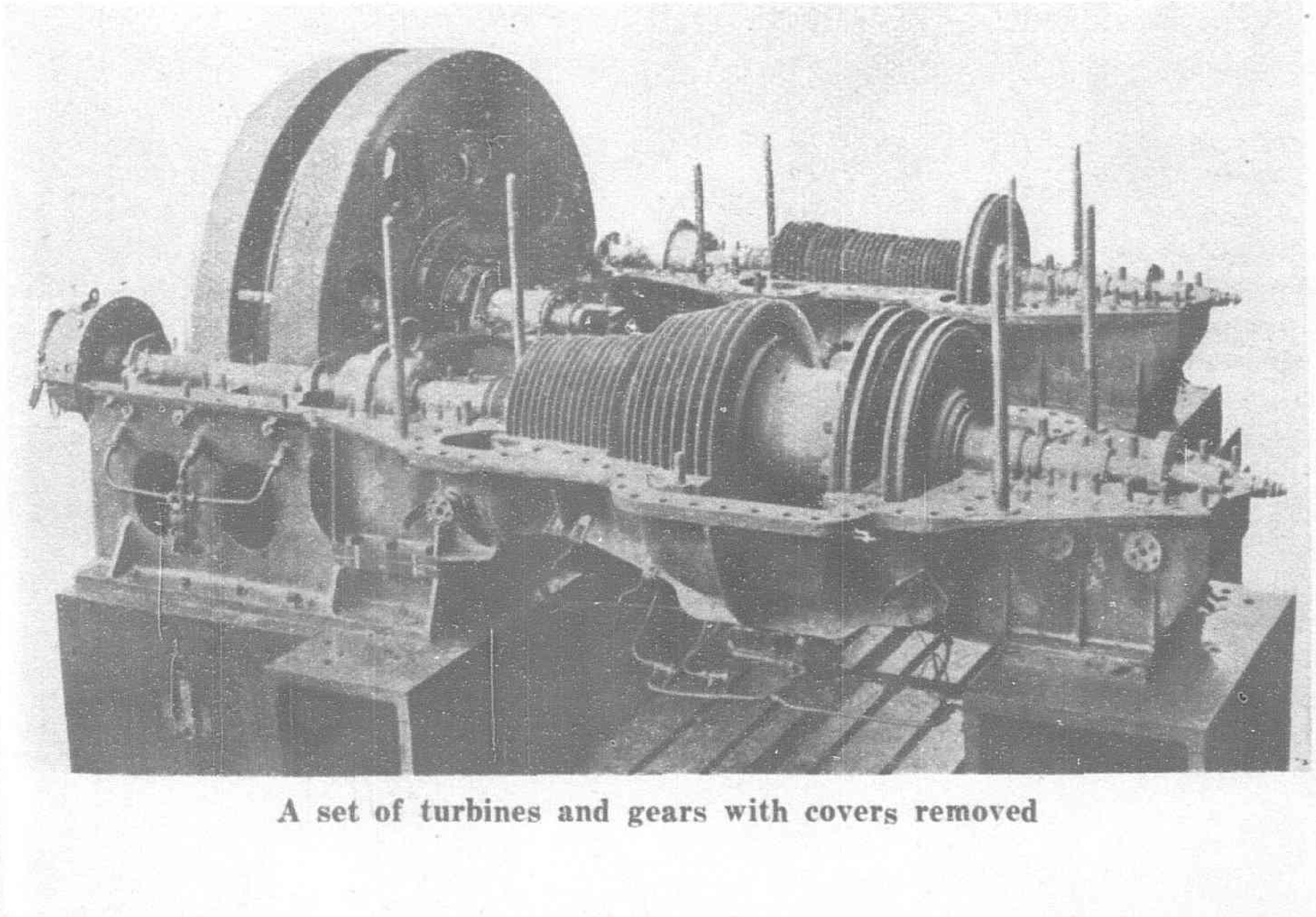
All the public rooms and state rooms are decorated and equipped most tastefully and comfortably with every convenience.

The first class dining-saloon, forward on the upper deck house, extends over the full breadth of the ship and the ceilings are arranged specially high. The decoration is in the Georgean style. The walls are panelled with polished special wood, enriched in harmony with the furnishings, and a large mirror is fitted above the center sideboard, while the floor is covered with special rubber tiles.

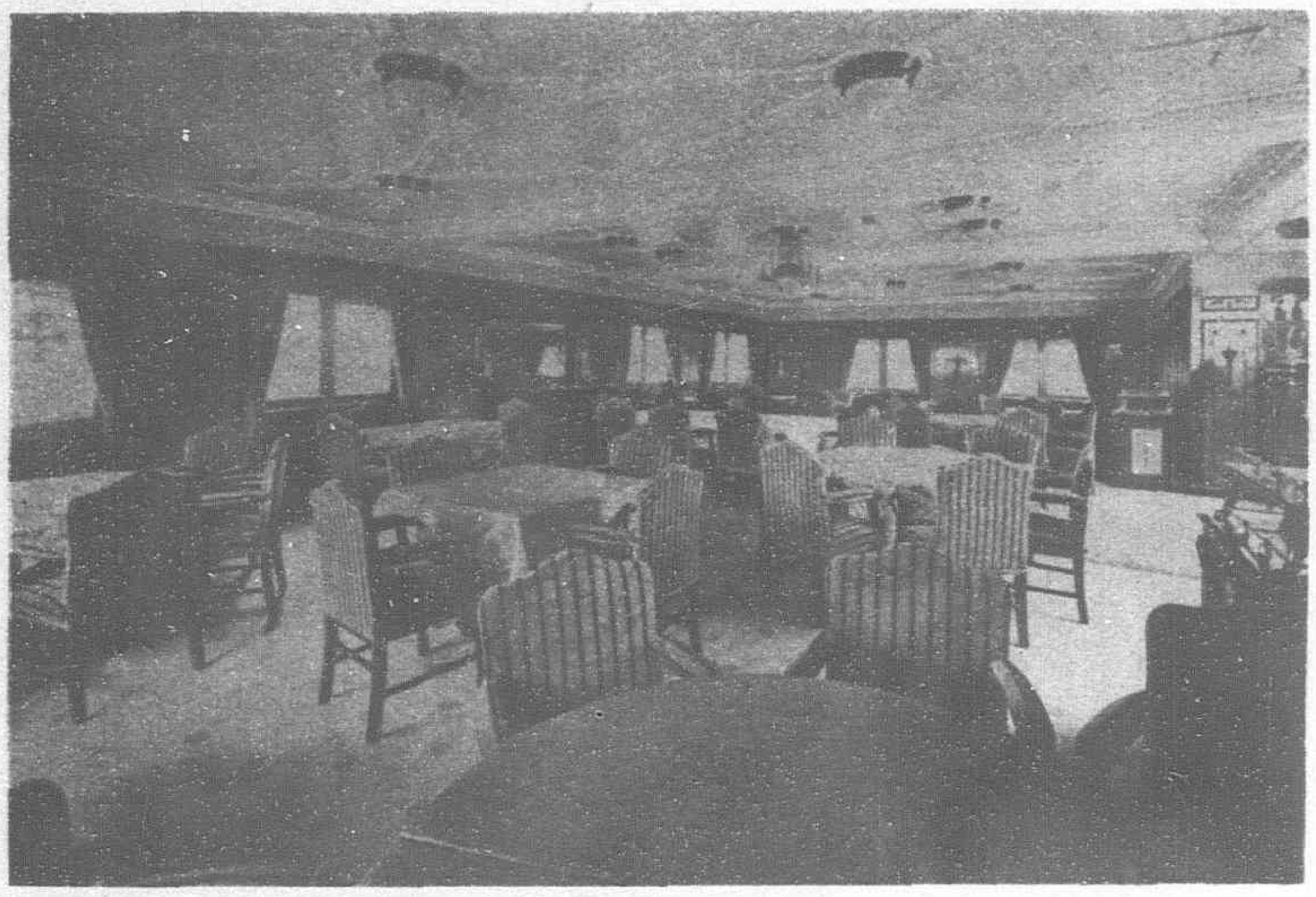
Behind the dining-saloon is a grand staircase with beautiful balusters and rails, which reach to the entrance hall on the promenade deck, decorated in pleasing Renaissance style. On the front of the stairway is mounted a handsome track indicating chart which shows the position of the ship, by means of an electric device.

The *en suite* room is arranged on the promenade deck abaft the entrance hall, comprising a drawing-room, a bedroom and a toilet-room, and is decorated in the Renaissance style. The first class smoking-room is aft of the promenade deck and the walls are panelled with polished hard wood, decorated in the Early Stuart style, with floors of rubber tiles.

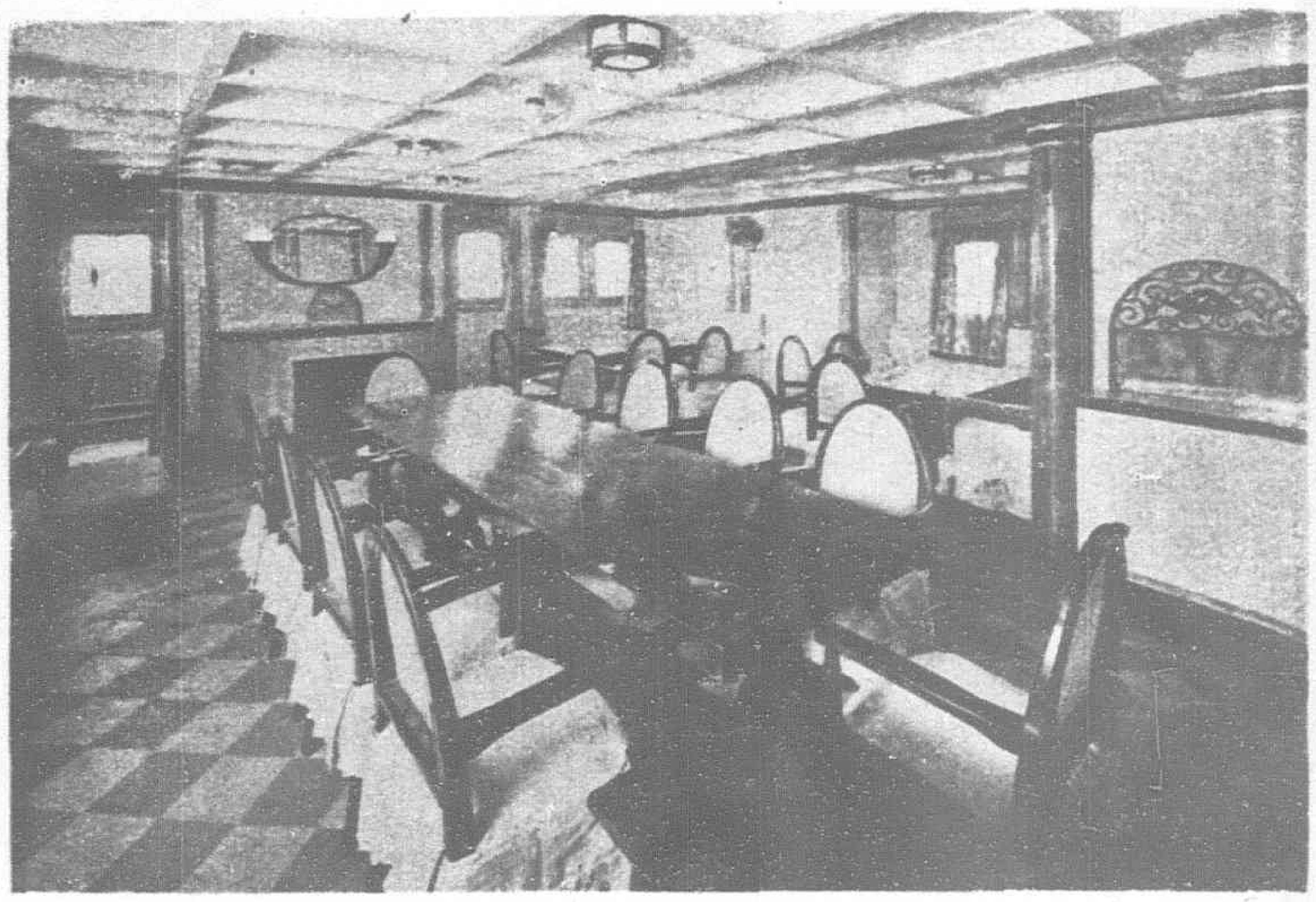
Behind the smoke-room is a verandah cafe, decorated in Old English style and provided with tables, chairs, plant stands, a gramophone, a wireless loud speaker, etc. The second class dining-room and smoking-room are situated on the aft part of the upper deck and are decorated in the



A set of turbines and gears with covers removed



First class dining saloon



Second class dining saloon

modern French style. All the first and second class state rooms are treated in the modern style, provided with the most up-to-date convenience.

There are two sets of Row's patent calorifiers, one for fresh water to the lavatory basins of the first class passengers and the other for fresh or salt water to baths for the first and second passengers.

Deck Machinery

All deck machinery is driven by steam power. Eight winches are installed for two ten-ton derricks for the second hatchway and for six three-ton derricks for Nos. 1, 3 and 4 hatchways, those for the last two hatchways are silent winches. A Clarke, Chapman's windlass for 2.1/16 inch cables with capstans clutched to it is provided on the forecastle deck.

The steering gear is of Brown Brothers' Wilson-Pirie type with a direct geared steam steering engine, controlled by telemotor from navigation bridge. A Caldwell's steam capstan is fitted on the upper deck aft, which can be operated as a direct steering engine in case of emergency.

A Mitsubishi patent multi-effect CO2 refrigerating machine of 20,000 B.T.U. is provided for the cold storage of provisions. This machine has the highest efficiency when cooling water temperature is very high. The compressor is of the steam driven vertical single acting type and a condenser is fitted behind the compressor frame, provided with a special pressure gauge for ensuring the easy and accurate handling of the machine. Further, the patent safety device for metal packings of piston rod and foul air discharging device are provided.

For the cooling of the cold chambers, the direct expansion system is adopted.

Miscellaneous Appliances

The navigation appliances comprise two sets of "Kelvite" dry card magnetic compasses of 10 inches diameter, Robinson's chain driven telegraphs for the engines, steering, docking and anchor work, Walker's patent "Trident" electric ship log, etc. This log is connected to the track indicator on the front of the grand staircase by means of a special electric device in order to show the position of the ship.

The natural system is adopted for the ventilation of the ship, while the cabins are steam heated. Ample daylight is available in all public rooms, state rooms, cabins and other living quarters. For the electrical lighting, two sets of 25 kw. generators are installed in the engine room.

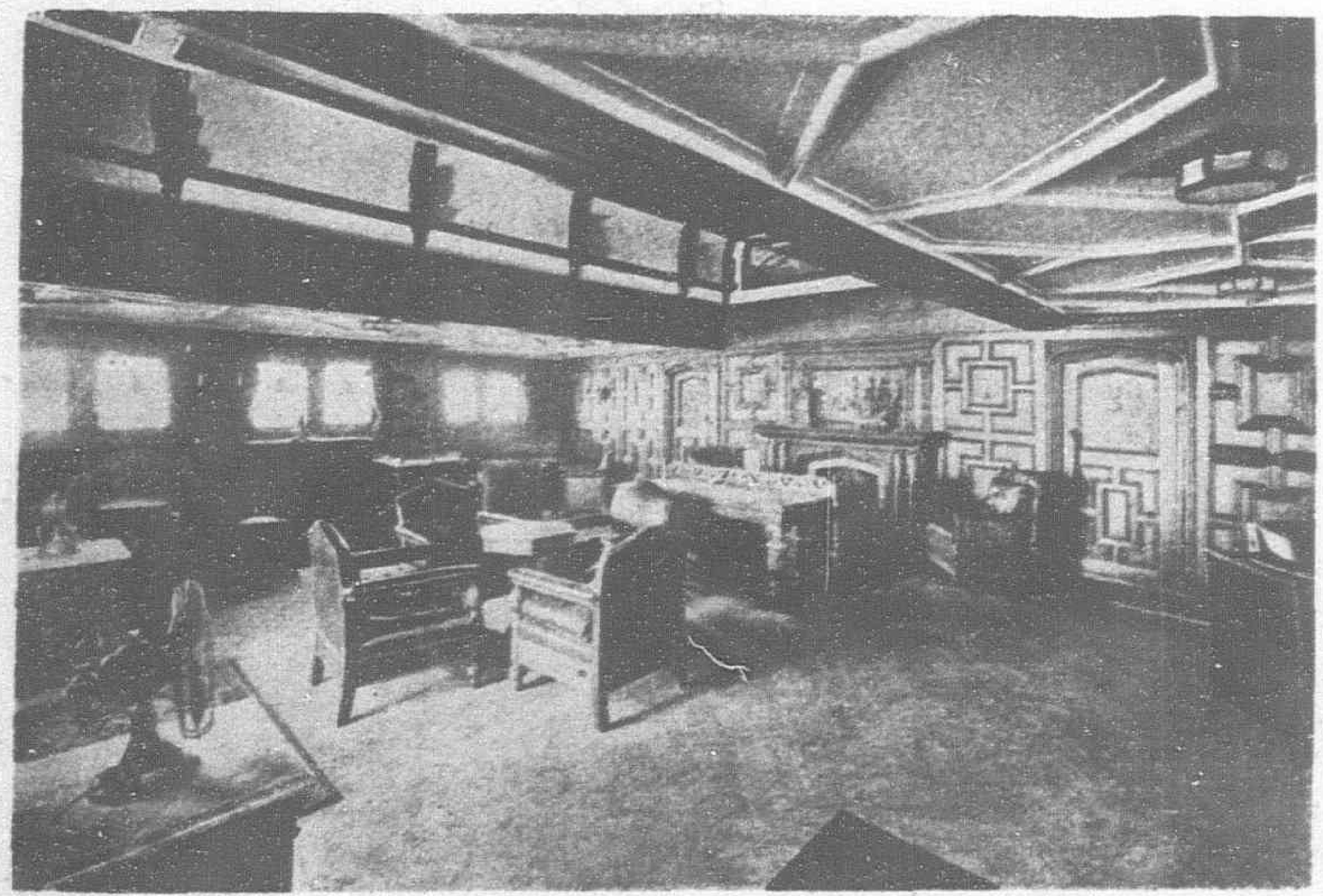
Propelling Machinery

The main propelling machinery comprises two sets of the Mitsubishi Impulse-reaction steam turbines, each driving a propeller through single reduction gearing, and develops a maximum shaft horse power of 4,500 in total.

The H.P. turbines are arranged inside, whilst L. P. turbines are at wing sides. Each H.P. turbine has one impulse stage and five reaction stages with 28 rows of moving blades, whilst the L.P. turbines are made conical shape and are of reaction type, with 22 rows of moving blades. The astern turbines are arranged in the forward parts of the L.P. turbines and develop a total maximum s.h.p. of 2,500.

All bearings are forced lubricated and the thrust bearings are of single collar type.

There are two sets of the Mitsubishi-Contraflo type condensers, each having a cooling surface of 2,010 sq. ft.



First class smoking room

Verandah cafe

The propellers are of aero-foil type, with a diameter of 8-ft. 3-in. and a mean pitch of 9-ft. 6-ins.

Boilers

Four sets of marine cylindrical boilers with Howden's forced draught system and Ezaki's superheaters are installed in the boiler room. The size of each boiler is 13-ft. 6-ins. in diameter and 11-ft. 6-ins. in length; service steam pressure being 200 lb. per sq. in., superheated at 120 degrees Centigrade, fitted with Cambridge distant thermometers.

Auxiliary Machinery

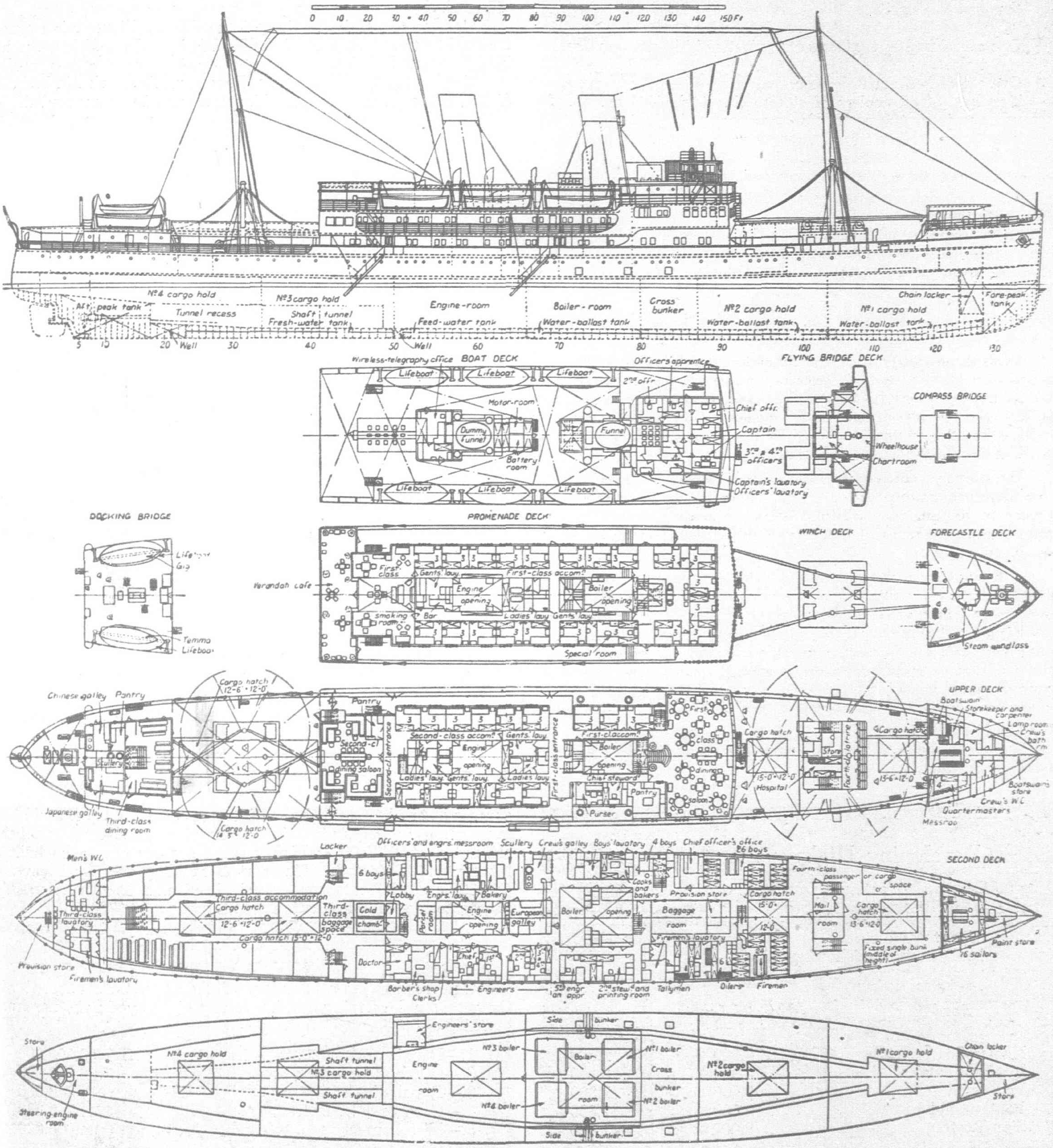
The following auxiliary machinery is installed in the machinery rooms :—

Two sets of air pumps of the Mitsubishi-Contraflo Kinetic reciprocating type with a capacity of nine tons per hour.

Three sets of feed pumps of the Mitsubishi-Weir Simplex type of 24 tons per hour.

Two sets of circulating pumps of centrifugal type (850 tons-hr.)

Three sets of forced lubricating oil pumps of the Mitsubishi-Weir Simplex type (38 tons per hour).



Japanese twin-screw turbine passenger steamship "Choshun Maru" built and engined at Kobe shipyard of the Mitsubishi Zosen Kabushiki Kaisha

One set of general service pumps of Worthington vertical type (30 tons per hour).
One set of ballast pumps of the same type (80 tons per hour).
One set of bilge pumps of the same type (35 tons per hour).
One set of sanitary pumps of the same type (50 tons per hour).
One set of fresh water pumps of the same type (25 tons per hour).
One set of ash ejector pumps of the same type (32 tons per hour).
One set of Howden's forced draught fans.
Two sets of 25 kw.—100 volt dynamos of Mitsubishi D.C. drip-proof compound type.
One set of the Mitsubishi multi-effect refrigerating machines.
One set of Sharple's lubricating oil purifiers (200 gallons-hr.)
One set of feed water heaters of the Mitsubishi-Weir contact type
One set of auxiliary condensers of the Mitsubishi-Contraflo Atmospheric type (400 sq. ft. cooling surface).
One set of feed water filters of the Mitsubishi-Contraflo Cascade type.
One set of Sea's ash ejectors.
Two sets of oil coolers of stream line type (650 sq. ft. for bearings, 500 sq. ft. for gearings).
Two sets of Kent's feed water gauges.
Two sets of Hopkinson's torsion meters.

Trial Results

In comparison with the sister ships *Dairen Maru* and *Hoten Maru*, considerable economy in power and steam consumption was attained in the trials of the *Choshun Maru*, as the result of the following improvement in the latter.

1.—The L. P. turbines were made conical in shape in order to minimize the loss of the steam flow between bladings.

2.—The propeller efficiency was increased by adopting the blades of an aero-foil shape.

3.—A double plated rudder was adopted in order to reduce the eddy resistance at stern.

The result of official trials are as follows :—

Weather :— Fine, sea calm.
Mean draught :— 13-ft. 2¼-in.
Corresponding displacement :— 3,333.5 tons.
Speed :— 17.228 knots.
Total s.h.p. :— 4,642.
R.P.M. :— 236.8
Propeller slip :— 22.45 per cent.
Boiler pressure :— 200 lb. per sq. in.
Steam temperature :— 530 degrees F.
Initial steam pressure at the H.P. turbines :— 117 lb.-sq. in.
Vacuum :— 28 inches.
Sea water temperature :— 82 deg. F.
Steam consumption of the main engines :— 8.976 lb. per s.h.p. per hour.
Coal consumption :— (Main engines) 1.236 lb. per s.h.p.-hr.

Developing Highways in Northwest

(Continued from page 622).

The total length of these five re-constructed roads will be 14,600 *kung li*. The total distance to be re-constructed on these five highways in shown in the following table :—

Road	*Total Length in kung li*	*Distance to be Re-constructed in kung li*
Kaolan-Ili	2,800	2,800
Kaolan-Shuleh	3,300	3,300
Paotou-Ili	3,000	1,300
Paotou-Shuleh	3,500	1,800
Sian-Paotou	2,000	1,800
	14,000	11,000

Out of the total length 11,000 *kung li* (or kilometers) the Kaolan-Ili road requires special attention. Along the Kaolan-Ili road complete reconstruction is necessary as the original road was only an earth track. Conversion of this crude surface into a modern road makes motor transportation possible, saving time and facilitating commercial development.

The first section of the Kaolan-Shuleh road is within the boundary of Sinkiang province. With the exception of the territory west of Tulan Temple, the land through which the road passes is on a plain, hence very little repair work to be done. In former days persons entering Sinkiang province proceeded through Liangchow and Yumenhwan, but since the construction of new road traffic passes by that route, which is better constructed than the old road.

The Paotou-Alshe section of the Paotou-Ili road is open to traffic, but the other part of the road is in bad condition, the bed being loose and shaky.

The Paotou-Shuleh and Sian-Paotou roads are also in bad condition, and a general scheme of improvement is recommended.

Cost of Proposed works

Out of 11,000 *kung li* to be re-constructed over 1,000 *kung li* have been already built and are open to traffic. Roads passing through mountainous districts require a larger amount of engineering work. For this reason about 1,500 *kung li* need special care in the vicinity of Hwangyuan, Tulan Temple, Yenma, Sinsinkan, Chikoutsing and Ili. At $4,000 per *kung li* the total cost of this work is estimated at over $6,000,000, while about 1,000 *kung li* at $1,000 per *kung li* will cost $1,000,000. The remainder of the work to be done on various roads is estimated to cost about $1,000,000, bringing the total cost of this project up to about $6,000,000.

Means of Transportation

On the various roads there are altogether 568 cars in operation including 468 cars and motor-buses, with 100 vehicles in reserve. The total cost of installing these cars is over $6,528,000 and the number running on different roads is shown below :—

Road	*Length in kung li*	*Days to travel*	*Vehicles in operation*
Sian-Paotou	2,000	8	64
Kaolan-Ili	2,800	11	88
Kaolan-Shuleh	3,300	13	108
Paotou-Ili	3,000	12	96
Paotou-Shuleh	3,500	14	112
	14,600		468

Garaging and Repairs

Eight repair shops are to be established at the following places: Paotou, Sian, Kaolan, Harmi, Dihwa, Ili, Shuleh and Machien, each shop costing about $30,000 or $240,000 altogether. Large garages are to be established at intervals of 250 *kung li* and about forty smaller garages at various other places, the total cost being estimated at $400,000. Eighty small garages are to be built at intervals of 80 *kung li*. The cost of building one small garage is $4,000, and the total under this head will be $320,000. The aggregate cost of construction for all garages is $720,000.

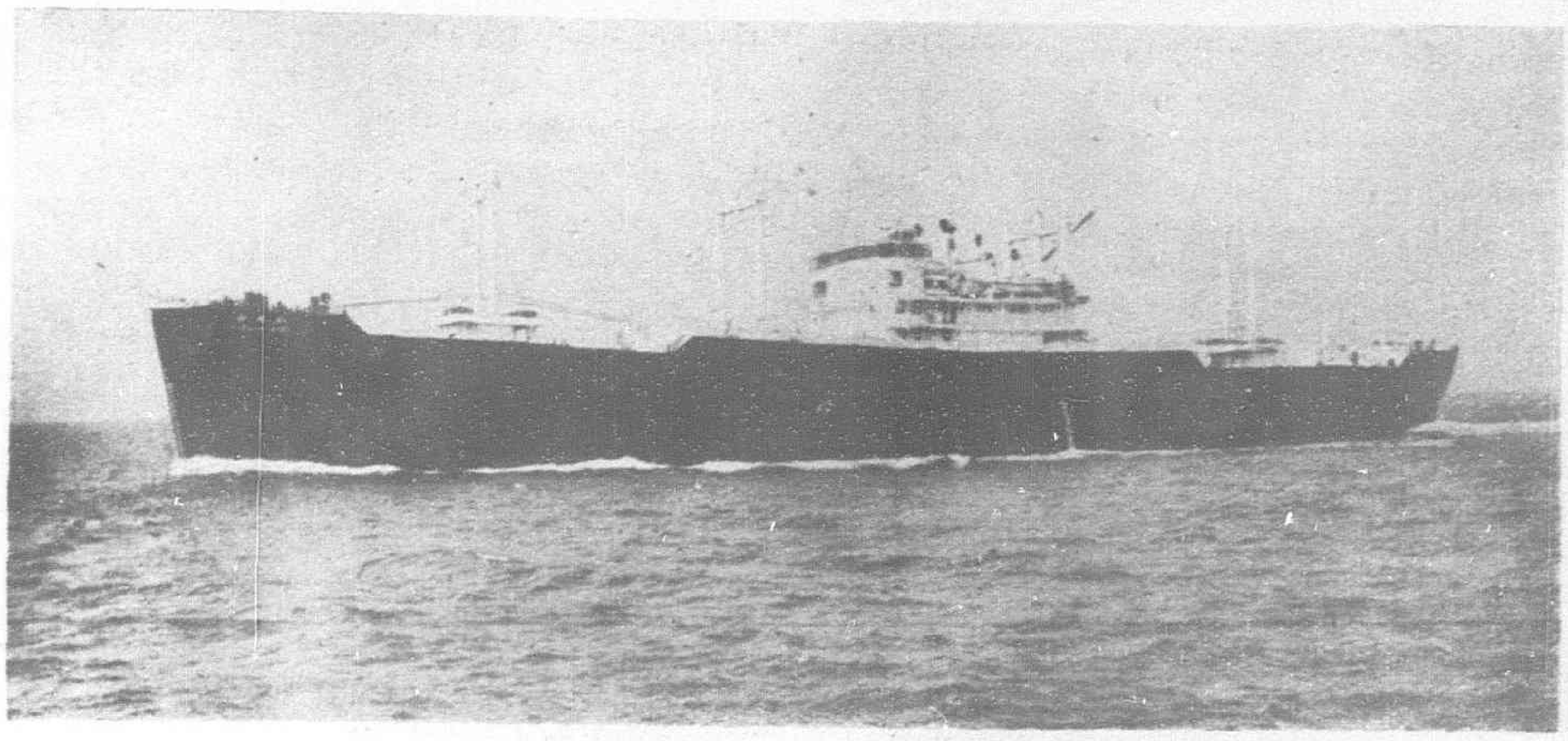
$16,488,000 Project

The following is a summary of the expenses connected with the plan for developing and improving highways in the northwest of China :—

1.—Repair works	$8,000,000
2.—Cars and Trucks	6,528,000
3.—Repair-shops	340,000
4.—Garages	720,000
5.—Miscellaneous	1,000,000
Total	$16,488,000

The New Motor Cargo Ship "Kurama Maru" of the K. Line

By Y. TAJI, M.I.N.A., M.I.Mar.E.



The "Kurama Maru" on Trial Run

THE *M. V. Kurama Maru* was recently completed in the Uraga Dockyard and is being operated on the Yokohama-Manila-New York service of the Kokusai Kisen Kaisha, Ltd. The vessel was originally ordered by the Yamashita Kisen Kaisha, Ltd. for their North Pacific service under the name of the *Hokusei Maru*. While the vessel was in course of fitting out in the dockyard, the Kokusai Kisen Kaisha purchased her from the Yamashita K. K. to be operated on their Orient-New York line and changed the name to the *Kurama Maru*. Consequently, a certain alteration was carried out to the original design in connection with the fittings and equipment as well as in some parts of the hull construction in order to suit the shipping condition of the new owners.

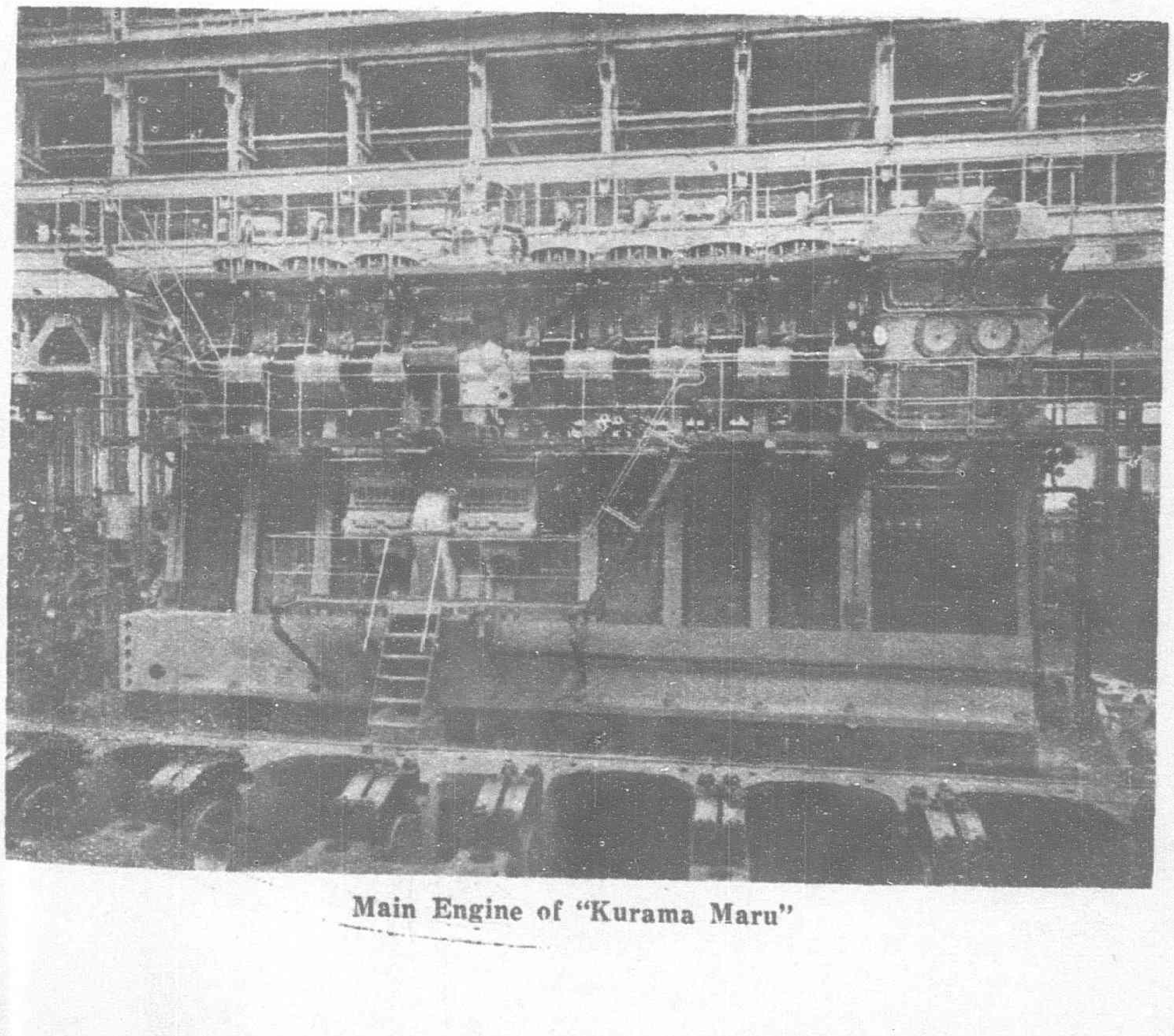
Leading particulars are as follows :—

Length over all	458-ft. 5-in.
Length b.p.	435-ft. 0-in.
Breadth moulded...	58-ft. 0-in.
Depth moulded	33-ft. 4-in.
Loaded draught	26-ft. 6.69-in.
Under deck tonnage	6,187.83 tons.
Gross tonnage	6,769.49 tons.
Registered tonnage	4,062.98 tons.
Dead weight capacity	10,192.96 tons.
Cargo capacity (bale)	556,123 cub. ft.
" " (grain)	605,675 cub. ft.

Main propelling machinery :—

One set of M.A.N. double acting air injection Diesel engine, type D7Z 60/90.

Normal output	4,000 b.h.p. at 117 r.p.m.
25 per cent over load output ...	5,000 b.h.p. at 120 r.p.m.
Trial speed	16.4 knots.
Sea speed (fully loaded)	13½ knots.



Main Engine of "Kurama Maru"

The vessel was constructed under the special survey of the Japanese Ministry of Communications as well as the British Corporation, and is classified as " the First Class Ocean Service Vessel " by the former and as B.S. with Freeboard by the latter.

Hull Construction and General Arrangement

The vessel is the largest and highest powered motorship of the single screw type under the Japanese flag and has many special characteristics. She has two complete continuous steel decks, a long bridge-deck, a forecastle and a poop with a cruiser stern. There are five pairs of twin derrick posts painted white, two of them being utilized as the masts with center poles erected at the middle of truss works connecting the derrick post crowns ; no funnel being provided, a dumpy oval trunk for silencer exhausts and a donkey boiler chimney opens up at the aft end of the boat deck.

The hull is subdivided into five cargo holds, an engine room, a deep tank, fore and aft peak tanks, by seven water-tight bulkheads. The double bottom extends over the whole length between the collision bulkhead and the aft peak tank bulkhead, mainly for the stowage of fuel oil. Its construction is of the patent Asakura-Ono longitudinal system with vertical members connecting upper and lower continuous longitudinals, except under the machinery space and the forward part. The transverse framing consists of channel and bulb angle bars, spaced generally 33 inches, while in No. 1 hold 27 inches and in peak tanks 24 inches.

The ship's form is of so called " straight frame system " or " the form of quadratic functions " originated by Mr. T. Ono, the chief designer of the Uraga Dockyard. One of the models designed under this principle was tested last year in the Hamburg Experimental Tank by Dr. Kempf, who, it is said, assured the superiority of this form over other forms ever tested in this tank under requests of foreign firms, but the inventor declines to publish the details of design, so that a further explanation is not available at present.

A special device called " steady helm guide vanes " or " patent directional stability fins " originated by the same inventor is fitted to the stern post so as to increase the propulsive and steering efficiency of the vessel in conjunction with the design of the propeller and rudder.

The propeller is of a radially increasing pitch type with four manganese-bronze blades of aerofoil sections, the diameter being 15-ft. 5-in., normal pitch 14-ft. 2-in., and developed area 69.5 sq. ft. The propeller boss is of cast steel with a stream line form of patent construction. The rudder is of a double plated stream line type of a trapezoidal shape.

OFFICERS' AND CREW'S ACCOMMODATION.—The captain's office and bed room, wireless office and operators' room and a spare room are arranged on the forward boat deck. On the upper bridge-deck are a spacious dining saloon with a pantry, officers' and engineers' rooms cabins for stewards, clerks and boys, baths and lavatories, etc., while the lower bridge-deck is arranged for sailors' and oilers' cabins, a crew's mess, a clerks' office, a ship's galley, an insulated meat chamber, baths and W.Cs., etc. Provisions, stores, etc. are provided on the upper deck.

Main and Auxiliary Machinery

The engine room is situated amidships, where the main engine, generators, air compressors, various pumps and other necessary auxiliaries are installed.

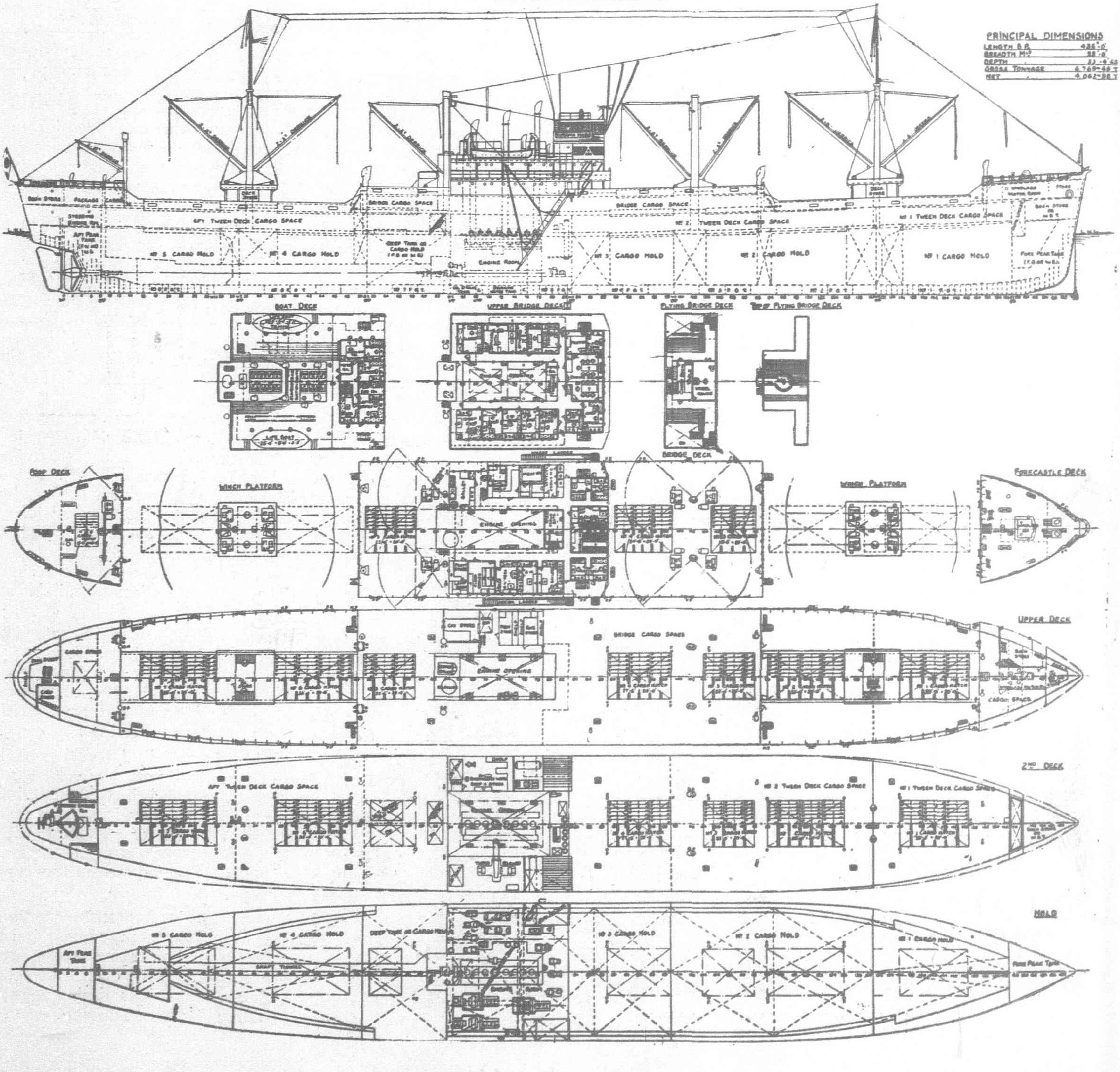
Main Engine.—The main propelling machinery is a M.A.N. double acting air injection Diesel engine of type D7Z 60/90 with seven cylinders of 600 mm. bore and 900 mm. stroke, developing normally 4,000 b.h.p. at 117 r.p.m. The main air compressor is direct coupled to the crank shaft of the main engine at the midway between the third and fourth cylinders. The cylinder covers and jackets are cooled by sea water, while the pistons by fresh water.

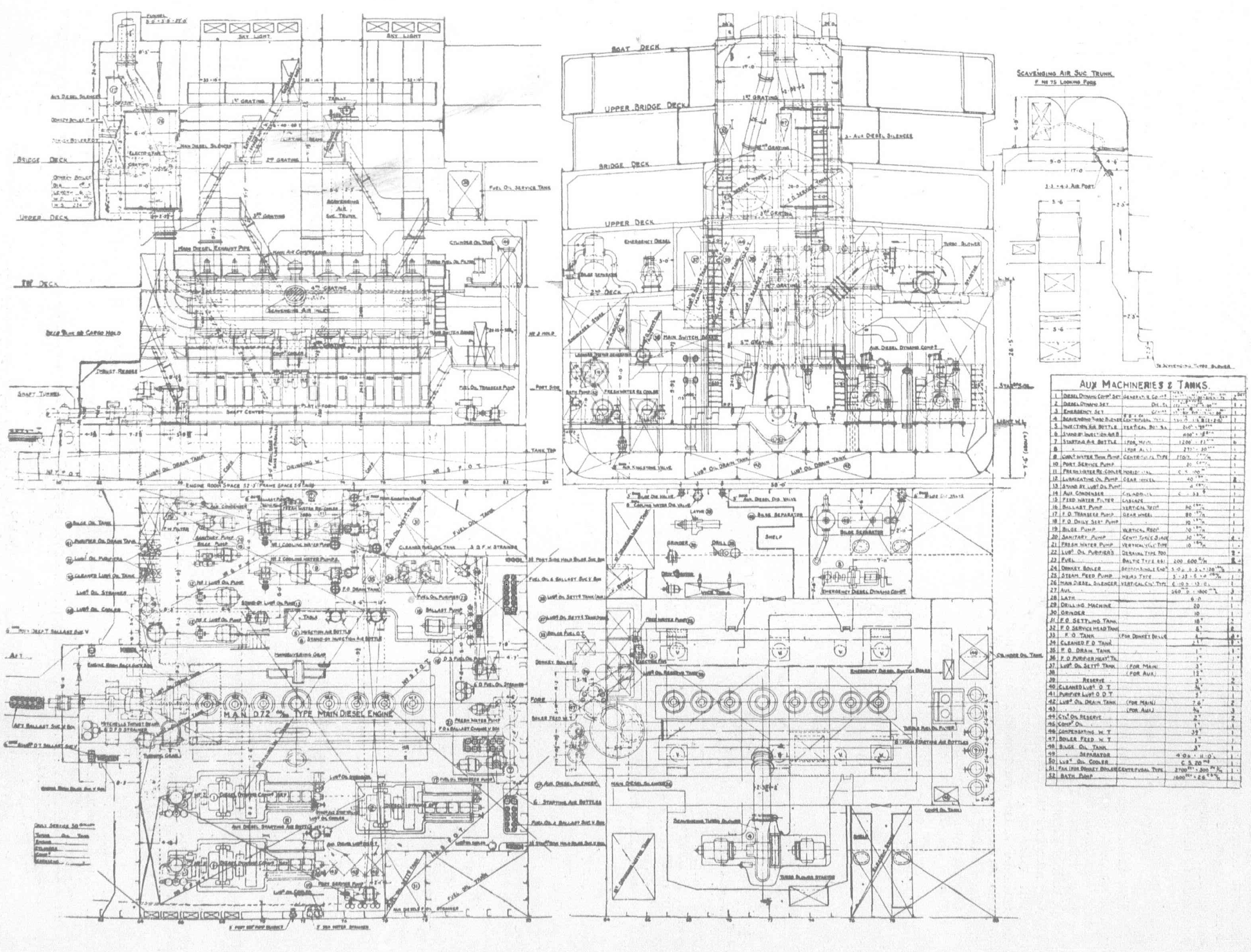
The design and construction of this engine are similar to those of the *M.S. Ryoyo Maru* (which is described in *The Motor Ship* of last March issue), except that the latter is all cooled by fresh water, while in the *Kurama Maru* the pistons only are cooled by fresh water, and higher output and also there are some differences in the auxiliaries.

The scavenging turbo-blower is of Brown-Boveri type with a suction air capacity of 540 cub.m. per min. and a delivery air pressure of 1,200 mm. of water column and is driven by two 210 h.p. electric motors. Noises of the turbo-blower are completely annihilated by means of the efficient sound insulation of suction air trunk and its careful arrangement, while the Diesel generators having been arranged in the opposite position of the main control platform, the engine room is exceptionally quiet, so as to avoid annoyance and irritation of the engineers on watch.

Electric Generators and Air Compressors.—There are three sets of 150 kw. Siemens dynamos, each driven by a M.A.N. G4VU42 type four cycle Diesel engine of 225 b.h.p. at 350 r.p.m.; two of them are coupled to Balkey's air compressors of a capacity of 320 cub.m. per hour. At sea, two generators are used, while another is on standby. The total capacity of the electric generating plant is much larger than that of the *Ryoyo Maru*.

S.S. MOTOR CARGO SHIP 'KURAMA MARU
GENERAL ARRANGEMENT





AUX MACHINERIES & TANKS.

1	DIESEL DYNAMO COMPR SET	GENERATOR & COMPR	[illegible]	2
2	DIESEL DYNAMO SET	DIE. [illegible]	[illegible]	1
3	EMERGENCY SET	[illegible]	[illegible]	1
4	SCAVENGING TURBO BLOWER	B B & Co CENTRIFUGAL TYPE	[illegible]	1
5	INJECTION AIR BOTTLE	VERTICAL BOT. SL.	240' × 49"	1
6	STAND-BY INJECTION AIR B.	"	400' × 18"	1
7	STARTING AIR BOTTLE	(FOR MAIN)	1200' × 13"	6
8	"	(FOR AUX)	275' × 30"	1
9	COOLG WATER TWIN PUMP	CENTRIFUGAL TYPE	150/2 [illegible]	2
10	PORT SERVICE PUMP		30 [illegible]	1
11	FRESH WATER RE-COOLER	HORIZONTAL	C.S. 100	1
12	LUBRICATING OIL PUMP	GEAR WHEEL	40 [illegible]	2
13	STAND BY LUBG OIL PUMP		4 [illegible]	1
14	AUX CONDENSER	CYLINDRICAL	C. 33	1
15	FEED WATER FILTER	CASCADE		1
16	BALLAST PUMP	VERTICAL RECIP	60	1
17	F.O. TRANSFER PUMP	GEAR WHEEL	80	1
18	F.O. DAILY SERV PUMP	"	10	1
19	BILGE PUMP	VERTICAL RECIP	10	1
20	SANITARY PUMP	CENTL THREE STAGE	30	2
21	FRESH WATER PUMP	VERTICAL CYL TYPE	10	1
22	LUBG OIL PURIFIER'S	DERAVAL TYPE 700		2
23	FUEL	BALTIC TYPE 661	200 600 G/H	2
24	DONKEY BOILER	SCOTCH SINGLE END	[illegible]	1
25	STEAM FEED PUMP	WEIRS TYPE	[illegible]	1
26	MAIN DIESEL SILENCER	VERTICAL CYL TYPE	[illegible]	1
27	AUX. "		560 D × 1800 L	3
28	LATH		6-0	1
29	DRILLING MACHINE		20	1
30	GRINDER		10	1
31	F.O. SETTLING TANK		18 T	2
32	F.O. SERVICE HEAD TANK		6 T	2
33	F.O. TANK	(FOR DONKEY BOILER)	4 T	2
34	CLEANED F.O. TANK		2½ T	1
35	F.O. DRAIN TANK		1 T	1
36	F.O. PURIFIER HEATG TK		1 T	1
37	LUBG OIL SETTG TANK	(FOR MAIN)	3 T	1
38	"	(FOR AUX)	1½ T	1
39	" RESERVE		3 T	2
40	CLEANED LUBG O.T.		¾ T	1
41	PURIFIER LUBG O.D.T.		1 T	1
42	LUBG OIL DRAIN TANK	(FOR MAIN)	7.6 T	2
43	"	(FOR AUX)	¾ T	3
44	CYLR OIL RESERVE		2 T	2
45	COMPR OIL		1 T	1
46	COMPENSATING W.T.		39 T	1
47	BOILER FEED W.T.		3 T	1
48	BILGE OIL TANK		3 T	1
49	" SEPARATOR		4-0 D × 11-0 L	1
50	LUBG OIL COOLER		C.S. 20 M2	1
51	FAN (FOR DONKEY BOILER)	CENTRIFUGAL TYPE	2700 [illegible] × 300 [illegible]	1
52	BATH PUMP	"	1600 [illegible] × 26 [illegible]	1

Further, for port use and emergency purposes, a 10 kw. generator combined with a compressor is installed on the second deck platform of the engine room, which is driven by a Diesel engine of 17 b.h.p. at 650 r.p.m. and the capacity of the air compressor is 15 cub.m. per hour at 60 atms.

OTHER ENGINE ROOM AUXILIARIES.—Apart from the generators and compressors, the following auxiliary machinery is installed in the engine room :—

Two main engine centrifugal cooling water pumps, one for sea water at 270 cb.m. per hr. and the other for fresh water at 75 cb.m. per hour.
One auxiliary centrifugal cooling water pump, 30 cb.m. per hr.
Two lubricating oil pumps of gear wheel type, each 40 c.m./hr.
One auxiliary lubricating oil pump of the same type, 4 c.m./hr.
One fuel oil daily service pump of the same type, 10 cb.m. per hr.
One fuel oil transfer pump of the same type, 80 cb.m. per hr.
One vertical reciprocating ballast pump, 80 cb.m. per hr.
One centrifugal 3 stage sanitary pump, 30 ,, ,, ,,
One vertical bilge pump, 30 ,, ,, ,,
Two ,, fresh water pumps, each 10 ,, ,, ,,
One centrifugal bath pump, 2.6 ,, ,, ,,
Two DeLaval's lubricating oil purifiers, 200 gallons each.
Two Baltic fuel oil purifiers, 200-600 gallons each.

and machine tools such as lathe, grinder, drilling machine, etc.

All these pumps and machines are electrically driven.

There are also a horizontal fresh water recooler with a cooling surface of 100 sq. meters, a lubricating oil cooler of 20 sq.m. an oil filter, a cylindrical auxiliary condenser of 53 sq.ft. and tanks for various purposes.

The air stowage comprises one 200 litre injection air bottle, one 400 litre standby injection air bottle, six 1,200 litre starting air bottles for the main engine and one 275 litre starting air bottle for the auxiliary engines, the air pressure being all 75 atms. except 30 atms. for the auxiliary engines. The main engine starting air bottles are fitted to the forward bulkhead of the engine room, whilst others are arranged near the engines.

In order to avoid the oil pollution as well as to recover oil from bilge, a special horizontal bilge oil separator invented by the Uraga Dockyard is installed on the second deck platform, this being a cylindrical type with a diameter of 4-ft. and a length of 11-ft.

There is also a donkey boiler of single ended Scotch type installed in the aft engine room casing on the upper deck together with a main engine silencer. The boiler has heating surface of 224 sq.ft., a diameter of 5-ft. and a length of 6-ft. 5-in. and a working pressure of 120 lb., all necessary accessories such as a feed pump, an oil burning set, etc. being provided complete.

The main Diesel silencer is of a vertical cylindrical type with a diameter of 6-ft. 10-in. and a length of 13-ft. There are also three auxiliary silencers of 56 mm. diam. and 1,800 mm. length.

It is noteworthy that the builders have taken the utmost precautions for the most efficient engine room arrangement, and the unusual position of the funnel, silencers and donkey boiler has made the engine room very airy, bright and comfortable compared with the usual arrangement.

Cargo Facilities

There are five pairs of twin derrick posts, two on the fore and aft upper deck serving as the fore and main masts, provided with high winch platforms utilized for deck stores, two on the bridge-deck and the rest on the foremost end of the poop deck; each being fitted with long Mannesman's steel derrick booms. No. 1 hold is provided with two five ton derricks and two three ton winches, No. 2 hold with two eight ton and two five ton derricks and two five ton and two three ton winches, No. 3 hold with wo five ton derricks and two three ton winches, No. 4 hold with two five ton and two one and a half ton derricks worked by two three ton winches and a five ton mooring winch. The twin posts at the aft bridge are for handling cargoes in the aft bridge cargo space and in the deep tank, which can be utilized as a cargo hold whenever necessary. The owners are going to use this for the carriage of cocoa-nut oil.

All the winches are of " Asea " spur geared electric type supplied by the Allmaenna Svenska Electriska Aktiebolaget of Sweden. The three ton winches are driven by 29 h.p. motors, while the five ton winches by 40 h.p. motors. The stern winch is of a special type extending athwartship and is used for the mooring of the ship as well as the handling of cargoes for No. 5 hold. The winches for the fore and aft twin post being installed on the considerably high platforms, deck cargoes can conveniently be embarked on the exposed upper deck, for that sockets for timber posts and a large number of ring plates are provided. A considerable quantity of lengthy articles can be also carried in the upper deck cargo space, No. 2 and aft 'tween deck cargo spaces.

Miscellaneous Arrangements

The steering gear is of an all electric type comprising a Siemens motor-generator for the Ward-Leonard control system, a 25 h.p. steering motor, a Wilson-Pierrie's type quadrant and emergency hand wheels. The electrical parts were supplied by the Fuji Electrical Engineering Co., Ltd., while the mechanical parts were manufactured by the Uraga Dockyard; the whole gear is controlled electrically from the navigation bridge. As mentioned before, the rudder is of a double plated type with stream line sections, and the patent directional stability fins are fitted to the front of the rudder post.

The windlass is also an electrical type, driven by a 60 h.p. motor at a lifting speed of 25-ft. per minute; this was manufactured by the Uraga Dock Co., the motor, controller and other electrical parts being installed below the forecastle deck.

All latest navigation appliances are fitted on the navigation bridge, including wireless apparatus of 1 kw. capacity and a radio direction finder of S.F.R. system, etc.

For fire extinguishing purposes, the X.U. system of CO2 piping is adopted, the capacity being in compliance with the requirements of the American Underwriters' Corporation which specify 50 lb. of liquefied CO2 for each 900 cub.ft. of the cargo hold space. The CO2 bottles are stored in a special room on the upper deck amidships.

An Escher-Wyss's " Autofrigor " is provided to the cold chamber. As to the life saving equipments, two 26-ft. life-boats and 18-ft. " Temma " are stowed on the boat deck.

Trial Results

Various trials were very successfully carried out near the entrance of Tokyo Bay, and a mean speed of 16.4 knots was recorded in the official trial, whilst an exceptionally high propulsive efficiency of 73.17 per cent was obtained in the four hours continuous running trial. The actual all round consumption of fuel has been about 14½ tons per day at 14 knots under a light load condition, and about 17½ tons at 13-13½ knots under a fully loaded condition.

A summary of the trial results is given below :—

		Full Power Official Trial	*Four hours Continuous Trial.*
Draught	fore	6-ft. 7-in.	6-ft. 8¾-in.
	aft	16-ft. 8-in.	16-ft. 6½-in.
	mean	11-ft. 7½-in.	11-ft. 7.6-in.
Displacement, tons		5,835	5,840
Mean speed, knots		16.438	15.543
Propeller slip, %		2.01	1.17
I. H. P., main engine		5,920	5,050
B. H. P., ,, ,, ...		4,990	4,190
R. P. M., mean		120	112.5
Propulsive efficiency, %		71.3	73.17

Traveling Around America

(Continued from page 635)

and the only line to keep the American flag continuously in the transatlantic passenger trade for half a century.

The American Line was founded in Philadelphia in 1872. Its ships became popular from their first voyages, and when, two decades later, the line removed to New York, it enjoyed international fame. When President Grant made his trip around the world at the conclusion of his term of office, he crossed the Atlantic in the *Indiana*, one of the original American Line ships.

In the nineties the American Line held the palm for speed across the Atlantic. The *New York* and *Paris*, its leading ships, were famous flyers, and were patronized by the elite of the traveling public. When the *St. Paul* and the *St. Louis* were built for the American Line service thirty years ago, they ranked as the largest American built ships.

The vessels of the Panama Pacific Line are entitled to fly the old American Line house flag with blue spread eagle on a white ground, since the owners of these ships also owned the American Line, and the new fleet for the intercoastal trade, headed by the *California*, are direct successors of its famous greyhounds of the sea.

Engineering Notes

INDUSTRIAL

SUBMITS PETITION.—A memorandum urging the immediate re-opening of the Hanyehping and Yangtsze Iron and Steel Works has been submitted to the Ministry of Industry at Nanking by the Greater Shanghai Chamber of Commerce. The petition says that the importance of developing native industries cannot be too much emphasized. In order to make such development possible, machinery will be required on a large scale.

TO MAKE SULPHATE OF AMMONIA.—A new 10 million yen corporation has been formed for the purpose of manufacturing sulphate of ammonia, with a joint investment by the Mitsui Mining Company and the Electro-Chemical Industrial Company. Of the total capital of Y.10,000,000 one quarter will be paid up. The principal factory of the company that will be constructed at Omuda, Kyushu, will be equipped to produce 30,000 tons of the fertilizer annually at the outset, while its productive capacity later will be increased to 100,000 tons per year. It is also understood that the products of the new company will be distributed solely by the Mitsui Company largely in the Kyushu district. The following industrial leaders are mentioned as directors of the company : Messrs. Kumao Fuwa, President ; Motoe Takashima, managing director ; Tamaki Makita, Ginjiro Fujiwara, and Eiichi Tatsumi, directors.

JAPANESE BLEACHING POWDER.—A Japanese scheme for a Y.500,000 capital co-operative sales company among the Japanese bleaching powder producers is now progressing. The promoters are Dai-Nippon Artificial Fertiliser Company, the Asahi Electro-Chemical Industrial Company, and five other electrolytic caustic soda companies. The new company will chiefly engage in seeking new outlets for bleaching powder, and will not touch upon market regulation questions such as the enforcement of the output curtailment. The curtailment rate for bleaching powder to-day is 55 per cent.

NEW RUSSIAN FACTORIES.—Soviet Russia took another step towards the goal of industrial independence when two giant factories for building automobiles and tractors were put into operation at Moscow and Charkov. Of these, the Moscow automobile works is expected to have an output of 25,000 cars a year, while the Charkov factory will have a capacity of 50,000 tractors.

WOOLLEN MILL FOR CHINA.—Establishment as soon as possible of a large-scale Government woollen factory for the manufacture of woollen piece-goods to meet domestic demands is urged by the Greater Shanghai Chamber of Commerce in a petition submitted to the Ministry of Industry at Nanking. The petition points out that woollens have become one of the necessaries of the people ; the value of the annual imports of woollens and serges having mounted to the startling figure of over Tls. 50 millions.

CHINESE GALVANISED-IRON PLANS.—Plans are being made for establishing in Shanghai a factory for manufacturing galvanised iron goods, of which about £2,000,000 worth are imported from Japan alone every year, which country supplies about 70 per cent. of China's requirements. It is proposed to build a factory capable of turning out 200,000 piculs per annum, which is about one-third the total yearly import. If the scheme materialises on the lines proposed, a factory will be built and plant installed before next summer, and a British technical expert has been already invited to go out to take charge of the works during the first six months of its operation. The capital of the proposed factory will be £60,000, and in the event of its operation proving successful, the promoters contemplate establishing similar works in other parts of China.

JAPANESE CHEMICAL INDUSTRY.—The Commission appointed by the Japanese Ministry of Trade and Industry for the purpose of supervising the development of home-produced chemicals, have added the following to the list of Japanese products, imports of which, they recommend, should be controlled. The Commission also recommend that in these cases it should be made obligatory to use domestic materials in connection with all Government contracts. The list is: Naphthalene, carbolic acid, cresol, salicylic acid, formaldehyde, acetic acid, stearic acid, industrial glycerine, sodium bicarbonate, sodium silicate, ammonium sulphate, and paraffin oil.

A SUBMARINE CABLE MANUFACTURE.—Tokyo Correspondent reports that the Japanese Government has considered the manufacture of submarine cables in Japan for many years. It is now said to have succeeded in arranging with the Sumitomo Electric Wire Works for the making of these cables, after long negotiations carried out with this works and two other big electric wire makers, the Furukawa and Fujikura concerns. The Sumitomo firm will establish a factory for the purpose somewhere in the Bay of Osaka at a cost of Y.600,000, besides which Y.400,000 will be employed as working funds. At first gutta-percha cables will be made by the factory, which will commence work at the end of 1932 or the beginning of 1933. It is not yet decided whether the above factory will be controlled by a new company or by the present Sumitomo Electric Wire Manufacturing Co., Ltd., but it is probable that for the first few years the latter course will be adopted, and that when the business is made to pay it will be made over to a new company. In the meantime the Sumitomo firm will be satisfied with a price nearly as low as that of imported cables.

JAPANESE WOOD-PULP PRODUCTION PLANS.—The Governor of Karafuto (Saghalien) has sanctioned a scheme for establishment of the Karafuto Pulp Manufacturing Company, formulated by directors of the Tokyo Rayon Company and several other leading businessmen. The Government will dispose of some 13,000,000 koku of lumber (1 koku is equivalent to 120 cub. ft.) to the proposed concern within the next twenty years. A stipulation of the Government is that the formation of the new company should be effected within six months after the sanction with a capital Y.10,000,000, and that the plants should be built within two years. The proposed company will produce some 21,600 tons of pulp annually, of which some 10,000 tons will be suitable for the manufacturing of rayon fibre. In addition the Oji Paper Manufacturing Company will establish a pulp mill in Karafuto, at a cost of about Y.3,000,000 to produce some 20,000 tons of pulp annually. The company has obtained the land, which covers an area of about 2,040 acres, and also a concession to cut down some 7,200,000,000 cub. ft. of lumber. The present consumption of wood-pulp by the Japanese artificial-silk industry is about 20,000 tons a year.

NEW MOTOR FUELS.—Patents in various countries have been granted to cover an elaborate process by which a composite motor fuel, invented in Japan, is produced. The Technological College of Osaka developed the process, which was patent in Japan last December. It consists of mixing with each 100 parts of crude oil one-tenth part of catalytic carbon and two parts of chrome mixture, a compound of Potassium bicloromate and sulphuric acid. After stirring and settling supernatant liquid is removed, neutrailsed with caustic alkali and water and then dehydrated. In the final process, 25 parts of industrial alcohol and one part of acetone are added, the final result being a yield of 90 parts of fuel gasoline, which product is understood to have physical properties similar to those produced by conventional refining or cracking. The second process covers the synthetic production of motor fuel from alcohol, which is produced in considerable quantities as a by-product of the Japanese sugar industry. Messrs. Mitsui and Company are reported to have acquired the patents for exploitation of the process, which was developed by the Japan Gasoline Company of Tokio.

GAS IN JAPAN.—The Journal of the Fuel Society of Japan states that water gas manufacture was first started in Japan in 1901 when the Tokio Gas Company put two small plants in operation. To-day the same Company has altogether fourteen such plants at work with a daily output of about 13½ million c.ft. The Gas Company of Osaka has also six plants producing a daily total of 9 million c.ft. ; the Gas Company of Kyoto has four plants turning out 2 million c.ft. ; and the gas undertaking of Nagoya two plants with an output of 1 million c.ft. per day.

PHILIPPINE FLOATING EXHIBIT.—A round-the-world floating commercial and industrial exhibit of Philippine industries, products, and general business is seriously considered by the Philippine Chamber of Commerce. The proposal calls for a government subsidy of $250,000 through legislation, and for subsidizing a Filipino-owned and managed steamer. Sufficient space will be reserved to carry from 3,000 to 4,000 tons of cargo for sale at the ports to be touched. Exhibits of the insular and provincial governments, as well as of private firms, will be featured. The proposition was evolved from an extensive scheme of the Chamber of Commerce of the Philippine Islands to promote foreign trade. (Trade Commissioner Harry V. Rohrer, Manila).

SHIPPING

NEW SHIP IN SERVICE.—Messrs. L. Everett, Incorporated announce that they have added the M. V. *Milagros* to their fleet of 9 inter-island vessels operating in the Philippine Islands. With the addition of the *Milagros* on the Manila/Masbate/Casiguran/Dousol run Messrs. Everett now have services to practically every trading port in the Philippines. The Philippine inter-island service of Everett line was started in 1928 with the S.S. *Kinau*, a vessel formerly operating inter-island in the Hawaiian Islands.

AIDS COLOMBO SHIPPING.—In order to facilitate shipping, portions of land bordering the Colombo Lake and the land on both sides of the Lake-to-Harbour Canal are being opened out. For some time past the land on both sides of the Canal have been in the hands of builders and the bank of the Canal on the side of the Chalmer's Graneries has now been converted into a fine Quay. It is known as the Chalmer's Quay and has been built for the purpose of the handling of rough cargo. When the road surface, which is now being tarred, is done the entire Quay, will be complete. New cranes have been installed for raising cargo from the Canal.

ANOTHER MERGER.—At an extraordinary general meeting of the shareholders of the D.K.K. (Dairen Steamship Co.) the amalgamation of the Manchuria Dock Co., on the basis of an agreement concluded between the parties concerned, was passed unanimously. Details of the amalgamation were left to President M. Yasuda of the D.K.K. Consequently the present capital of Y.25,000,000 was increased by Y.700,000 or 14,000 shares of Y.50 per share. Accordingly, besides the shipping and warehousing businesses conducted heretofore, construction and repairs of vessels, engines, other machinery, etc., together with shipwreck salvage, were added to the Company's businesses. The Manchuria Dock Co. was renamed the Dock Works of the D.K.K., with the Port Arthur Works for branch works. The staff of the Dock Co. were taken over by the D.K.K. which assumed the management of the Dock Co.

JAPANESE SHIPPING MERGER.—Five of the smaller Japanese steamship companies, the Mitsui, Kawasaki, Yamashita, Daido and Kokusai lines have organized the Kaiun Kyowakai, or Co-operative Shipping Union, in order to cope with the prevailing depression, the new organisation will have its headquarters in Kobe. The combination represents about 2,000,000 tons of shipping.

PORT IMPROVEMENTS.—The Japanese Government proposes to expend 22 million yen on the improvement of fifty ports and harbours. Among the places concerned there are :—Misumi, Oita, Sakata, Hososhima, Hiroshima, Shikama, Kishiwada, Uo, Tokushima, Nishinomiya, Miyazu and Shin-Maizuru, Akashi, Mogi, Ebisu and Teradomari, Nakaminato, Matsusaka, Taketoyo and Handa, Shimoda, Ishimaki, Kamaishi, Kamo, Itozaki, Wakayama, Uwajima and Mitsugahama, Unoshima, and Karatsu.

RAILWAYS

NEW LOCOMOTIVES.—Fourteen new locomotives of the C-54 type which are capable of developing fully 95 kilometres per hour are being put into operation within the jurisdiction of the Tokyo, Osaka, and Sendai Railway Divisions. The locomotives have been under construction since last spring at the Kawasaki Rolling Stock Plant at a cost of Y.75,000 per engine to meet with the Railway Office's plan to realize the speeding-up of trains on all Government Railways. They were completed some time ago. The locomotives are similar in type to the C-51 locomotive attached to the super limited express " Tsubame " which is running between Tokyo and Kobe. They are superior in their interior structure to the C-51 engine, however. In addition to this, all the weak points discovered in the C-51 have been eliminated and the newest equipment possible has been used. The new engines are of 1,300 horse-power each.

REVENUES DROP.—Japanese Government railway revenues continue to decrease. The railway proceeds from both passenger and freight services last year indicated a decrease of Y.56,000-000 but a still greater deficit is anticipated this year. During the first half of the current fiscal year ending September, the proceeds show a decrease by Y.19,000,000 as compared with the period of last year. Detail follow :—

	First half of 1931	*Decrease*
Passengers	127,899,000	12,337,000
Freights	82,053,000	6,764,000
Total	209,952,000	19,120,000

TUNNEL OPENED.—The Shimizu Railway Tunnel, the longest in the Orient and the ninth longest in the world, has been opened providing vast improvements in railway travel between the Sea of Japan and the Pacific Coast of the Empire. The tunnel is 6¼ miles long. It will reduce travelling time between Tokyo and Akita by 3 hours and 56 minutes. Pilgrims to the famous Zenko-ji Temple, a shrine for Buddhists in Nagano, by three hours.

MINING

NEW COAL DEPOSITS.—News from the Kiangsu Province of China states that new coal deposits have been discovered on the Chiawan coalfield at Chiachiawan, near Hsuchow. The seams, which had been worked by three shafts, appear to have been exhausted, but another deposit has been found. It consists of three seams, the top being 2-ft. thick, the middle 4-ft., and the bottom 6-ft. Three shafts, between 30-ft. and 40-ft. in diameter, have been sunk for a distance of 300-ft., and about 200 tons of coal are being brought to the surface daily. With the introduction of electric mining machinery it is hoped to increase the output very considerably, and selling agencies are being established at points along the Tientsin-Pukow and Nanking-Shanghai railways with a view to finding new markets for this coal.

CHINESE MINE AMALGAMATION.—In accordance with its plan to improve the mining administration in the country, the Ministry of Industries, in an order to the various Provincial Departments of Agriculture and Mining, instructs that all small mines, the terms of whose concessions have expired and which have not been satisfactorily developed in accordance with the Mining Law, should be amalgamated with neighbouring mines for the expansion of mining operations.

GRANT CONCESSION.—The Liaoning Provincial Government has granted a concession to private Chinese interests for the development of the rich coal deposits discovered at Weitaohtse and Weitangkow, north of Shenyang. A concession has been given to the mining company for a period of thirty years under Government supervision. The deposits cover a total area of nearly 6,000 mow.

COAL IN CHINA.—Preparations are in hand for a survey of the colliery at Leichiakou, China. It is estimated that the mine can be reorganised to give a daily output of 1,500 tons of coal for the Pukow iron and steel works near Nanking, which are shortly to be opened.

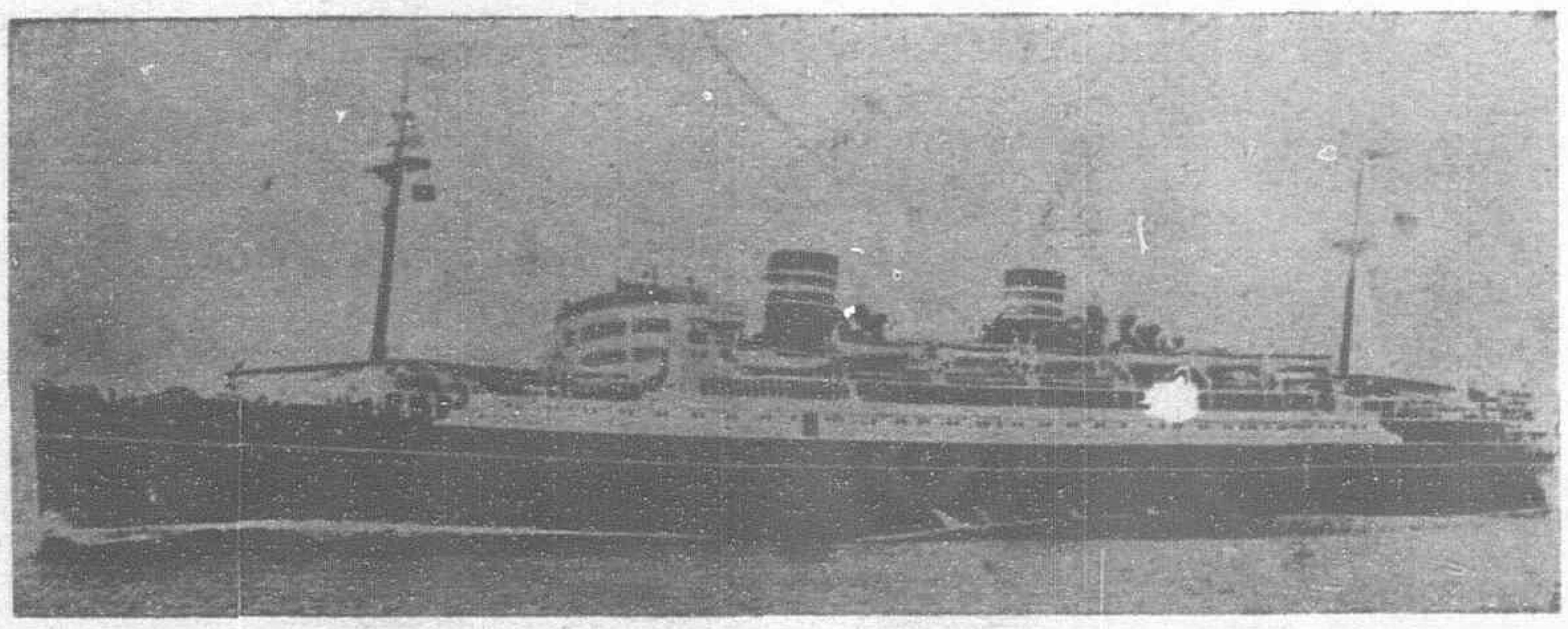
OIL AT SIKONG.—Reports received in Nanking at the Mongolian and Tibetan Affairs Committee state that a large petroleum oil well has been discovered by a British engineer while exploring Ningching Hill, in southern Sikong. The British engineer has returned home to report to his Government with a view to staking a claim to the well, it is said. The Committee has telegraphed to the Chinese authorities and Mr. Tang Ho-san, Special Commissioner to Sikong, for a detailed report.

SULZER
BROTHERS

SHANGHAI ENGINEERING OFFICE
4 AVENUE EDWARD VII.

Telegraphic Address
"SULZERBROS" SHANGHAI
Telephone 16512

蘇爾壽工程事務所
上海愛多亞路四號
本公司常備樣本供奉各界
垂詢工程事務亦竭誠酬答



N.Y.K. Motor Liner "Asama Maru" Propelled by Four 8-cylinder Sulzer Two-cycle Diesel Engines Totalling 16,000 B.H.P.

Other Products :

Steam Engines and Boilers, Air and Gas Compressors, Centrifugal Pumps and Fans, Borehole Pumps, Stationary and Marine Diesel Engines, Ice-making and Refrigerating Plants, Maag Gears and Maag Planing Machines.

WINTERTHUR. SWITZERLAND.